PHOTOCATALYTIC REDUCTION OF CO_2 WITH SOLVENT ON ALUMINA SUPPORTED WITH TIO_2

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of Bachelor of Chemical Engineering (Gas Technology).

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STUDENT'S DECLARATION

I declare that this thesis entitled "Photocatalytic Reduction of CO_2 with Solvent on Alumina Supported with TiO_2" is the result of my own research except as cited in references. The thesis has not accepted for any degrees and is not concurrently submitted in candidate of any other degree

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Special dedication to my beloved parents.

Mohd Zahariman Bin Harun and Mahizan Binti Ismail

My dedicative supervisor

Madam Nor Khonisah Binti Daud

My supportive fellow friends

For all your willingness, cooperation and care towards me.

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PHOTOCATALYTIC REDUCTION OF CO_2 WITH SOLVENT ON ALUMINA SUPPORTED WITH TIO_2

ABSTRACT

Carbon dioxide accounts for the largest share of the world's greenhouse gas emissions. There is a growing need to mitigate CO_2 emissions. One of the strategies to mitigate CO_2 emissions is using CO_2 as a raw material in chemical processes. Reactions involving CO_2 typically required high energy input and energy substrate. One of the best routes to reduce CO_2 is to transform it to hydrocarbons via photo reduction method. Before that, the methods of preparing catalyst such as sol-gel method and hydrothermal method were studied. Addition of metal oxide such as alumina to TiO_2 will changed the distribution of electrons and they prevented the electron hole recombination, thereby enhancing the photo catalytic efficiency in production of methanol. Therefore, hydrothermal method is expected give higher performances of catalyst compared to Sol Gel method. In addition, the effect of catalyst dosage for photo reduction process will be studied. The variety dosages of Al_2O_3-TiO_2 catalyst used are0.5 g, 1.0 g, 1.5g and 2.0 g. The period of reaction for each catalyst dosage is 6 hours which the sample is withdrawn for every 1 hour. Lastly, the sample of methanol is analysed using HPLC.

PENGURANGAN FOTOPEMANGKIN CO_2 DENGAN PELARUT TERHADAP ALUMINA YANG DISOKONG OLEH TIO_2

ABSTRAK

Karbon dioksida merupakan penyumbang terbesar kepada pelepasan gas rumah hijau di dunia. Terdapat satu keperluan yang semakin meningkat untuk mengurangkan pelepasan CO_2. Salah satu strategi untuk mengurangkan pelepasan CO_2ialah dengan menggunakan CO_2 sebagai bahan mentah dalam proses kimia. Reaksi yang melibatkan tenaga CO_2 biasanya memerlukan tenaga input yang tinggi dan tenaga substrat. Salah satu jalan terbaik untuk mengurangkan CO_2 adalah dengan mengubahnya kepada hidrokarbon melalui kaedah proses pengurangan foto dengan pemangkin. Sebelum itu, kaedah penyediaan pemangkin seperti kaedah sol-gel dan kaedah hidroterma perlu dikaji terlebih dahulu. Penambahan logam oksida seperti alumina terhadap TiO_2 akan mengubah pemindahan elektron dan menghalang penggabunganelektron lubang semula, dengan itu ia akan meningkatkan kecekapan foto pemangkin dalam pengeluaran metanol. Oleh itu, kaedah hidroterma dijangka memberi persembahan pemangkin yang lebih tinggi berbanding dengan kaedah sol-gel. Di samping itu, kesan dos pemangkin terhadap proses pengurangan foto juga dikaji. Pelbagai berat dos pemangkin Al_2O_3-TiO_2 yang digunakan adalah 0.5 g, 1.0 g, 1.5g dan 2.0 g. Tempoh tindak balas bagi setiap dos pemangkin adalah 6 jam dan sampel diambil pada setiap 1 jam. Akhir sekali, sampel metanol dianalisis menggunakan HPLC.

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LIST OF SYMBOLS

°	degree
° C	degree celcius
Psi	pascal
e^-	negative electron
eV	electron volt
g	gram
h	hour
h^+	positve electron
M	Molarity
mA	mili ampere
mL	mili litre
ng/ μL	nano gram per micro litre

LIST OF ABBREVIATIONS

TiO_2	Titanium dioxide
Al_2O_3	Aluminium oxide
HPLC	High pressure liquid chromatography
CH_3OH	Methanol
H_2SO_4	Sulphuric acid
H_2O	Water
OH	Hydroxide
$Ti(OC_3H_7)_4$	Titanium-tetra-isopropoxide
H	Hydrogen
CO_2	Carbon Dioxide
NAOH	Sodium Hydroxide
C	Carbon
BET	Brunaeur-Emmett-Tellar
XRD	X-Ray diffraction
C_2H_5OH	Ethanol

CHAPTER ONE

INTRODUCTION

1.0 Overview

According to the intergovernmental Panel on Climate Change (IPCC), (2001), the earth's surface temperature has risen by approximately 0.60 K in the past century, which particularly significant warning over the past two decades (Phairat Usubharatana et. al., 2006). After study, it is proved that the main contributor to this phenomenon is CO_2 emission from fuel combustion especially. The higher concentration of CO_2 is increasing in the atmosphere. This heating effect on earth produced in this way will caused the greenhouse effect and global warming. The excessive heating on earth and its atmosphere can have effect on our climate, which will affect us and all living beings. The climate will change into gradually hot. When temperature keeps rising all over the years, this will also affect the human health. It will approach to many diseases like skin cancer and badly fever (Phairat Usubharatana et. al., 2006).

A great deal of effort has been expanded to reduce CO_2 emissions from the industries where the largest percentages of fossil fuels are used. Some of the strategies to reduce CO_2 emission are energy conservation, carbon capture and storage and using CO_2 as a raw material in chemical processes. But some of them are very costly, with significant energy required for CO_2 stripping and solvent regeneration. However, there is one potential technology was introduced in reducing CO_2 recently. The technology of process called photo catalytic method.

Photo catalytic technology process can be applied for CO_2 removal with simultaneously converting CO_2 to marketable products such as methanol. Another potential feature of the photo catalytic reduction of CO_2 is the use of solar energy for the reaction or another ultraviolet light source can be used (Rajasalakshmi, 2011).

In this study, the photo catalytic reduction process using semiconductor materials to promote reaction in the presences of UV light was used. If we examine the thermodynamics of CO_2 reduction, we can find that the direct one-electron reduction of CO_2 to CO_2^- is a very energy intensive. So, the used of semiconductor such as aluminium oxide promoted with titanium dioxide as a catalyst for photo catalytic reduction process has received a lot of attention for several reasons. So that, their absorption properties can be tunes to capture visible light and their reduction potentials can be tuned to match the potential required of CO_2 reduction (David and Etsuko, n.d).

The main product from photo catalytic reduction of CO_2 is methanol. Methanol is light, volatile, colourless, flammable liquid with a distinctive odour very similar. At room temperature, it is a polar liquid, and is used as an antifreeze, solvent, fuel, and as a denaturant for ethanol. It is also used for producing biodiesel via Trans esterification reaction. Methanol is a common laboratory solvent. It is especially useful for HPLC, UV/VIS spectroscopy and LCMS due to its low UV cut off. The largest use of methanol by far is in making other chemicals. About 40 % of methanol is converted to formaldehyde and from there into products as diverse as plastics, plywood, paints, explosive, and permanent press textiles. Methanol is also used, as the primary fuel ingredient since the late 1940s, in the power plants for radio control, control line and free flight airplanes.

1.1 Problem Statement

Due to an increasing atmospheric CO_2 level in environment, an urgent need for the discovery of carbon neutral sources of energy to avoid the consequences of global warming should be find. An attractive possibility is to use CO_2 captured from industrial emissions as a feedstock for the production of useful fuels and precursors such as methanol.

An active field of research to achieve this goal is the development of catalysts that capable of harnessing solar energy for use in artificial photosynthetic processes for CO_2 reduction. Transition metal complexes are excellent substances, and it has already been shown that they can be used to reduce CO_2 with high quantum efficiency. In this study, alumina promote with titanium oxides catalyst was used in order to obey the fact that transition metal is a good catalyst to absorb the visible light and trap CO_2.

Photo catalysis is the main process for this case. It makes use of semiconductors to promote reactions in the presence of light radiation. Unlike metals, which have a continuum of electronic states, semiconductors exhibit a void energy region, or band gap, that extends from the top of the filled valance band to the bottom of the vacant conduction band. It is occur when it exposed to the light of radiation.

1.2 Research Objectives.

This objectives of this research are:

- To identify the best method for preparing of Al_2O_3 / TiO_2 catalyst
- To study the effect of catalyst dosages on photo reduction process.

1.3 Research Scopes

- In order to achieve objectives, a few activities were carried out. Al_2O_3 / TiO_2 catalyst was prepared using two different methods which are hydrothermal and sol-gel method. These methods includes various techniques of crystallizing substances at high temperature and high pressures aqueous solution. In hydrothermal method, preparation of catalyst was performed in an apparatus consisting of a steel pressure vessel called autoclave, in which a nutrient was supplied along with water at 121 ºC.

- Sol-gel was another method that can be used besides hydrothermal. It involves the formation of sol followed by formation of a gel, typically uses either colloidal dispersion material at 70 ºC.

- The parameter such as dosages of catalyst was varied in order to investigate the effect of the amount of catalyst that used in photo reduction process. The variety of catalyst dosage were performed from 0.50, 1.0, 1.5 and 2.0 g for each prepared catalyst.

1.4 Organization of the Thesis

This thesis consists of five chapters which are introduction, literature review, methodology, results and discussion and also conclusion. The first chapter is introduction which deals with describing information about photo catalytic process and the main problem due to the high concentration of CO_2 in atmosphere. The problem statement, research objectives and scope of the research was also represented.

Chapter two deepens on literature review that supported the photo catalytic reaction process. Some of mechanism of reaction equations also was stated.

Chapter three is research methodology which reviews about procedure to complete the experiment. The procedure involves such as method in preparing catalyst and photo catalytic reaction process.

Chapter four is where result is tabulated and explanations about discussion. There are two figures involved to support the results.

Chapter five is the last chapter that conclude overall about the thesis. Some recommendations regarding the experiment also are stated.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

A hot button topic for the last decade has been the effects of CO_2 on the environment. The CO_2 accounts for the largest share of the world's greenhouse gas emissions due to its concentration in Earth's atmosphere has increased during the past century. There is a growing need to mitigate CO_2 emissions. Some of the strategies to mitigate CO_2 emissions are energy conservation, carbon capture and storage and using CO_2 as raw material in chemical processes. Reactions involving CO_2 typically require energy input and/or a high energy substrate. The energy source should be provided without producing more CO_2, such as solar energy. One of the best routes to remedy CO_2 is to transform it to hydrocarbons such as methanol via photo reduction process. There by, solar energy is transformed and stored as chemical energy (Rajalakshmi, n.d).

The emission of CO_2 into the atmosphere, released mainly by the burning of fossil fuels is one of the most serious problems with regard to the greenhouse effect (Anpo, 1995). All human activity generates about 37 billion tons (37 Gt) of CO_2 emissions each year, with about 30 Gt of this coming from energy-related emissions. Total emissions were less than 25 Gt twenty years ago, and under business as usual scenarios, emissions are projected to rise to over 50 Gt twenty years from now. Burning 1 tonne of carbon in fossil fuels releases more than 3.50 tonnes of CO_2 (Maginn, 2010). The Earth's surface temperature has risen by approximately 0.60 K in the past century, with particularly significant warming trends over the past two decades. Hence CO_2 reduction/management (capture, storage & sequestration) has become a key issue in controlling global warming. **Figure 2.1** shows the level of CO_2 concentration in atmosphere from July 1990 – 2011.

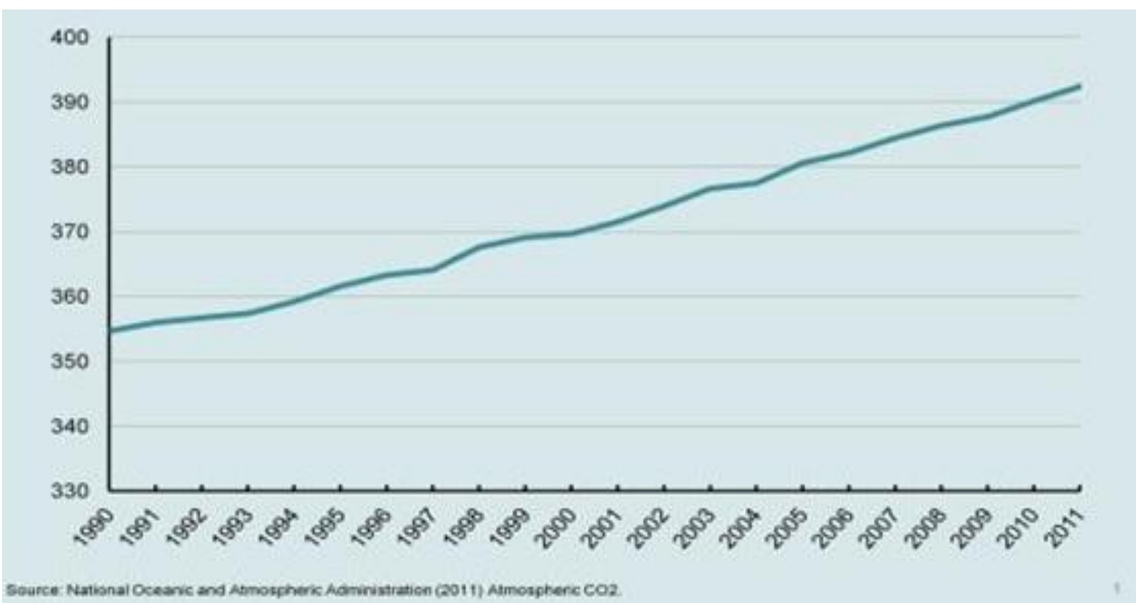

Figure 2.1 : CO_2 concentration in atmosphere, July 1990 – 2011 (Maginn, 2010).

Level of CO_2 concentration in atmosphere was increased from year 1990 until 2011. This is due to the effect of transportation or industrial sector that involve in releases CO_2 on atmosphere. The increasing level of CO_2 in atmosphere cause bad effects to environments such as human health, aquatic life and also flora and fauna (Murgatroyd, 2001).

CO_2 is the linear molecule consists of a carbon atom that is doubly bonded to two oxygen atoms, O=C=O. Although CO_2 mainly consists in the gaseous form, it also has a solid and a liquid form. It can only be solid when temperatures are below -78 ^oC. Liquid CO_2 mainly exists when CO_2 is dissolved in water. CO_2 is only water-soluble, when pressure is maintained (Alexandra Juniper, 2001).

There are two properties of CO_2 which can be divided into physical and chemical properties. The physical properties of CO_2 are its gas has a slightly odour and colourless and heavier than air. It can freezes at -78.5 °C to form CO_2 snow and the density is 1032 kg/m^3. Whereas for chemical properties of CO_2, it has vapour pressure about 58.5 bar and latent heat of vaporization at 571.08 kJ/kg. Although CO_2 is non-toxic and bacteriostatic, but it still can harm to the environment that cause greenhouse effect (Murgatroyd, 2001).

2.1 Photocatalyst Reduction of Carbon Dioxide (CO_2)

Photo-catalysis in simple meaning is acceleration of photoreaction in the presences of catalyst. It makes use of semiconductors like titanium dioxide (TiO_2) to promote reactions in the presence of light radiation. Different to metals, which have a continuum of electronic states, semi-conductor exhibit a void energy region, or band gap, that extends from the top of the filled valance band to the bottom of the vacant conduction band when exposed to light radiation (Phairat Usubharatana et. al., 2006). In photo-generated catalysis also, the photo-catalytic activity (PCA) depends on the ability of the catalyst to create electron-hole pairs. The catalyst will generate free radicals such as OH^- to able undergoes secondary reaction (Phairat Usubharatana et. al., 2006).

Due to increasingly level of CO_2 in atmosphere, the greenhouse effect problem is obvious. Photo-reduction of CO_2 then become in the future an alternative solution not only for environmental problems caused by CO_2 emission, but also for finding ways to maintain hydrocarbon resources which now on are being dominated by fuel and natural gas (Slamet et. al., 2009). The CO_2 reduction process is thermodynamically uphill as illustrated by its standard free energy of formation ($\Delta G° = 394.359$ kJ/mol) (Indrakanti, 2009). Economical CO_2 fixation is possible only if renewable energy, such as solar energy, is used as the energy source. Equally difficult is the reduction splitting of NaOH to yield hydrogen and hence requires similar combination of activation steps. The most ideal and desirable process would then be the simultaneous reduction of CO_2 and NaOH to yield methanol (Indrakanti, 2009).

According to Saeki et. al., (n.d) who studied the electrochemical reduction of CO_2 under various pressures galvano statically at 200 mA/cm^2 in a methanol medium. The results show that the current efficiency (ratio of the electrochemical equivalent current density for a specific reaction to the total applied current density) of CO_2 reduction increased from 23 % at 1 atm (0.10 MPa) to 92 % at 20 atm (2 MPa). High pressure enhances the reaction, as reflected in the increased equivalent current density. This effect can be applied to photo-catalysis with the same amount of energy supplied to the identical system. The difference between electrochemical reduction and photo-catalysis is the source of electrons. Electrons from the electrochemical process are supplied by an applied current; electrons for photo-catalysis are supplied by a semiconductor exposed to light radiation (Saeki et. al., n.d).

In photo-catalytic reduction, TiO_2 can affect the efficiency and selectivity of the methanol produced. The most crucial problem is a low quantum yield in the photo-catalysis process due to electron and positive hole recombination. In order to increases yield, TiO_2 must be modified by using dopants of metal. In CO_2 photo-reduction, Yamashita et. al., (n.d) reported that the addition of copper could improve the efficiency and selectivity to produce methanol.

Since CO_2 is a relatively inert and stable compound, its reduction is quite challenging and difficult to do. The reduction involves conversion and removal methods that require high-energy input which meant high temperature and pressure conditions. Conversely, photo catalysis occurs under relatively mild conditions with lower energy input when the reaction is activated by solar energy or other light resources (Phairat

Usubharatana et. al., 2006). Actually solar energy has the advantages which are; it can be used continuously and readily can be power supply.

The relationship of using TiO_2 as a semiconductor catalyst promotes the reaction in the presences of light sources. The function of TiO_2 is to create the band gap or void energy region. The band gap is characteristic for the electronic structure of a semiconductor and is defined as the energy interval (ΔE_g) between the valence band (VB) and the conduction band (CB). VB is defined as the highest energy band in which all energy levels are occupied by electrons, whereas CB is the lowest energy band without electrons. According to the band gap model, VB electrons are transferred to the CB when the semiconductor is illuminated with photons having energy content equal to or higher than the band gap, creating electron–hole pairs (Demeestere et. al., 2007).

Actually the UV light sources emit the electron that have energy equal or greater than band gap in order to transfer the electron to the band gap due to make it chemical reactions in the photo catalytic process possible. Migration of electron and holes to the semiconductor surfaces is followed by transfer of photo induced electron to absorb the solvent (Phairat Usubharatana et. al., 2006). The electron process will be more efficient if the species are absorbed on the surface. At the surface, the semiconductor, TiO_2 can donate electron to acceptor by using pathway A. The hole can migrate to the surface where they can combine with electron from donor species in pathway B. **Figure 2.2** shows the mechanism of photo excitation process.

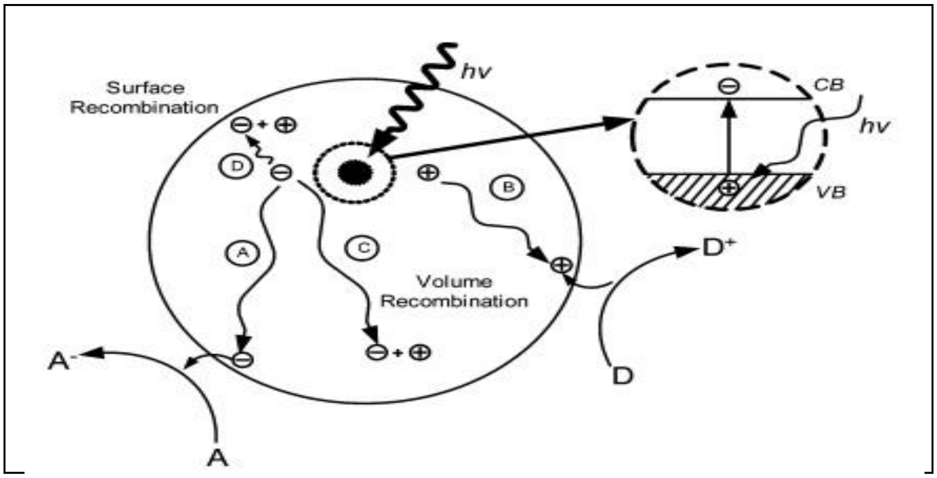

Figure 2.2: Photo excitation in solid followed by de-excitation (Seng et. al., 2006)

The first step involving photo catalytic splitting of solvent such as water follows the well-accepted elementary steps as shown in Eqs. (2.1) to (2.6).

$TiO_2 + hv \longrightarrow e^- + h^+$ (2.1)

$H_2O \longrightarrow H^+ + OH^-$ (2.2)

$H^+ + e^- \longrightarrow H.$ (2.3)

$OH^- + h^+ \longrightarrow OH.$ (2.4)

$2OH. \longrightarrow H_2O_2 + h^+ \longrightarrow O_2^- + 2H^+$ (2.5)

$O_2^- + h^+ \longrightarrow O_2$ (2.6)

The second step for activation and reduction of CO_2 could then follow different pathways. Anpo et. al., (n.d) have identified ESR signals due to C and H atoms, CH_3 radical and Ti^{3+} ion on powdered titania catalyst in presence of CO_2 and water at 77 K.

Accordingly, the following pathway Eqs. (2.7)-(2.13) involving the formation of active surface carbon and its reaction with H and OH radicals (Anpo et. al., n.d).

$$CO_2 + e^- \longrightarrow {}^{\bullet}CO_2^- \quad (2.7)$$

$$^{\bullet}CO_2^- + {}^{\bullet}H \longrightarrow CO + OH^- \quad (2.8)$$

$$CO + e^- \longrightarrow CO^- \quad (2.9)$$

$$^{\bullet}CO^- + {}^{\bullet}H \longrightarrow {}^{\bullet}C + {}^{\bullet}OH^- \quad (2.10)$$

$$^{\bullet}C + {}^{\bullet}H^+ + e^- \longrightarrow {}^{\bullet}CH \longrightarrow {}^{\bullet}CH_2 \longrightarrow {}^{\bullet}CH_3 \quad (2.11)$$

$$^{\bullet}CH_3 + {}^{\bullet}H^+ + e^- \longrightarrow {}^{\bullet}CH_4 \quad (2.12)$$

$$^{\bullet}CH_3 + {}^{\bullet}OH \longrightarrow CH_3OH \quad (2.13)$$

Observation by Yang et.al. (n.d), on the formation of carbon residues and ESR evidence on hydrogen, methyl and methoxy radicals and $CO3^-$ anion radicals by Dimitrijevic et.al (n.d). on titania surface during CO_2 photo catalytic lend credence to this mechanism. Besides, CO as one of the reduction products has been reported on titania and metal supported titania. Methanol is formed through surface methoxy species and its further reduction results in methane production.

The rate of a photo catalytic reaction especially depends on the type of the photo catalytic semiconductor and on the light radiation that it used in its initiation (Koci et. al., 2008). **Table 2.1** shows the different of semi-conductor has different band of gap energy consume in photo catalytic reduction.

Table 2.1: Varies of semiconductor of photocatalyst with their band gap energy **(**Kabra et. al., n.d)

Photo catalyst	Band gap energy (eV)	Photo catalyst	Band gap energy
Si	1.1	TiO_2 rutile	3.02
Wse_2	1.2	Fe_2O_3	3.1
R-Fe_2O_3	2.2	TiO_2anatase	3.23
CdS	2.4	ZnO	3.2
V_2O_5	2.7	$SrTiO_3$	3.4
WO_3	2.8	SnO_2	3.5
SiC	3.0	ZnS	3.7

ZnS has the highest band gap energy which is 3.7 eV compared to TiO_2 rutile and anatase. In photo catalytic reduction process, electron is being emitted due to the heat sources from UV light. H^+ from hydrogen molecules will combine with CO_2 to produce the methanol.

The generation of electron-hole pairs (e--h+) and its reverse process are shown in Eqs. (2.14) and (2.15), respectively where hV is the photon energy, e- represents a conduction band electron, and h^+ represents a hole in the valence band. The mechanism process involves by simple equation is shown in Eqs. (2.14) and (2.15).

$$\text{Photo catalyst} \longrightarrow e^- + h^+ \tag{2.14}$$

$$e^- + h^+ \longrightarrow \text{heat} \tag{2.15}$$

The photo-reduction of CO_2 by water is readily available and inexpensive. Two important species involved in CO_2 photo-reduction are H (hydrogen atom) and CO_2^- (carbon dioxide anion radical) produced by electron transfer from the conduction band. For methanol formation of photo catalytic reduction process is shown in Eq. (2.16) :

$$CO_2 + 6H^+ + 6e^- \longrightarrow CH_3OH + H_2O \qquad (2.16)$$

2.2 Alumina / TiO_2 Catalyst

Titania is an active material for photo catalytic reduction of CO_2 with H_2O, but the rates are extremely low since its conduction band edge is not suitable for water and CO_2 reduction, though it can readily oxidize water (Varghese et. al., 2009). The function of titanium dioxide is as a semiconductor to absorb the light radiation with the threshold wavelength that provides sufficient photon energy to overcome the band gap between the valence and conduction bands. This threshold wavelength, required to promote the excited state, corresponds to the minimal photon energy and depends on the band-gap energy. For example is TiO_2 anatase with band gap energy 3.23 eV has a wavelength of 387.5 nm (Koci et. al., 2008). The light wavelength influences the yield of CO_2 photo catalytic reduction products; irradiation using the light with shorter wavelength (254 nm) is significantly more effective for the CO_2 reduction using TiO_2 than that with the wavelength of 350 nm (Matthews and McEvoy, 1992).

Among the various semiconductor materials, TiO_2 is the most widely used photo catalyst due to its non-toxicity, high activity, large stability, and low cost. The range of organic pollutants that can be completely photo mineralized using TiO_2 is very wide and includes many aromatics, dyes, and pesticides. The photo-catalytic activity of titania varies depending on its crystallinity, particle size, crystal phase, surface area, and the method of preparation. It is known that anatase form with small particle size and high crystallinity is required to obtain highly active titania photo-catalysts (Funda et. al., 2006).

Although the reduction using semiconductor such as TiO_2 as a photo-catalyst was reported with low efficiencies, but when various metal such as alumina deposited with TiO_2, it can accelerate the reduction of CO_2 and that Al_2O_3 deposited on TiO_2 worked as the most efficient photo-catalyst for producing methanol from CO_2 compared to other metals deposited on TiO_2 (Tatsuto et. al., n.d). According to Koci et. al., (2009) who was studied the effect of TiO_2 particle size on photo catalytic reduction of CO_2, as the particle size decreased; higher yields of methanol and methane over the TiO_2 nano particles under the illumination of light were obtained.

The role of alumina that deposited on TiO_2 as a promoter for catalyst to increase the rate of photo-catalytic reduction in order to produce methanol. The heterogeneous catalyst of TiO_2-Al_2O_3 was prepared by using two different methods which were sol-gel method and hydrothermal method.

2.3 Preparation of TiO_2-Al_2O_3 Catalyst

2.3.1 Hydrothermal Method

Hydrothermal synthesis is a promising method to obtain a nano-crystalline titania particles. The hydrothermal process is the process where the chemical reaction could take place under auto-generated pressure upon heating, and it is efficient to achieve the crystalline phase at relatively low temperatures (Funda et. al., 2006). Hydrothermal method has already been applied since products prepared by this method which is methanol can have a good crystalline phase, which benefits to the thermal stability of the nano-sized material.

Another advantages using this method, are hydrothermal process can proceed with aqueous or non-aqueous system as the reaction medium and its environmental friendly since the reaction is carried out in a closed system (Funda et. al., 2006). In particular, the particles prepared through hydrothermal synthesis are expected to have large surface area, smaller crystallite size, and higher stability than those obtained by other methods (Funda et. al., 2006).

This method is includes various techniques of crystallizing substances from high temperature aqueous solutions at high vapor pressure. It also can be defined as method of synthesis of single crystal that depends on solubility of minerals in hot water under high pressure. The crystal growth is performed in an apparatus consisting of a steel vessel called autoclaved. Nutrient is also supplied along with water. A gradient of temperature is maintain at opposite ends of the growth chamber so that the hotter end dissolves the nutrient and the cooler end causes seeds to take additional growth (Laudise, 1986).

The function of autoclave is as crystallization vessel that has thick walled steel cylinders with a hermetic seal, which can withstand under high temperature and pressure for prolonged period of time. The important element of autoclaved is its closure. Many designs have been developed for seals. The temperature and the amount of solution added to the autoclave largely determine the internal pressure produced. It is method that is widely used for the production of small particles in the ceramic industry (Spezzia, 1905).

According to Kasuga et. al., (n.d), when TiO_2 is treated in 10 M NaOH aqueous solution for 20 h at 150 °C without need for a template, a nanotubes with 8 nm diameter and 100 nm length were obtained. When titania is mixed with a suitable amount of alumina, the increase in photo-catalytic efficiency has been attributed to improve thermal stability, the surface area and surface acidity. The increase in surface area with a reduction in particle size means an increase in the number of active sites on which the electron acceptor and donor are adsorbed and participate in the redox reaction. Additionally, it is reasonable that mixing TiO_2 with Al_2O_3 is an effective method to improve the content of surface adsorbed of NaOH and hydroxyl groups, and increase the photo-catalytic activity (Sadiye et. al., 2006).

2.3.2 Sol-Gel Method

Sol and gels are two forms of matter in colloidal state, which are either available in nature (milk, serum) or prepared by chemical synthesis. The activity for synthesizing inorganic materials by sol-gel processes began in 1846 with Ebelman's discovery of SiO_2 formation upon hydrolysis of tetraethylorthosilicate (TEOS) under acidic conditions (Maria Vittoria, n.d). In 1864, studies on the structure of inorganic gels confirmed that a gel consisted of a solid network with continuous porosity (three dimensional molecular networks). In the mid-1970s the interest in sol-gel process increased significantly when monoliths were produced by carefully drying the gel (Sakka Kamiya, 1980).

Nowadays, the sol-gel process is used to prepare various types of materials or catalyst. The sol-gel method is based on inorganic polymerization reactions. It is involving four basic steps which are hydrolysis, poly-condensation, drying and thermal decomposition of precursors. These are usually metal organic compounds such as metal alkoxides M(OR)n or oxoalkoxides MO(RN)n, where R is associated with saturated or unsaturated aryl or alkyl groups, in some cases with metal carboxylates M (O_2CR)n , (Maria, n.d) .

When specifically preparing TiO_2 material by using sol gel method, titanium alkoxide is often used as precursor. **Figure 2.3** shows the steps of preparation of catalyst in sol-gel method.

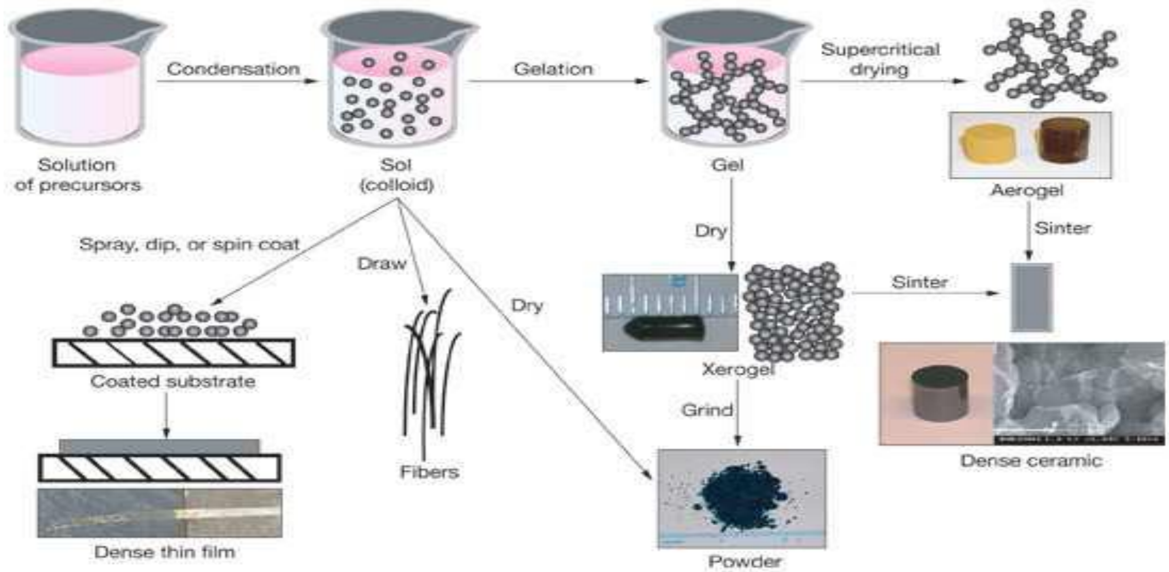

Figure 2.3: Overview of sol-gel method.

The sol-gel approach has numerous advantages. For instance, it allows tailoring of both the bulk properties (such as phase composition) and the surface characteristics (such as the surface area, the total pore volume distribution, etc) of a material on a nanometer scale from the earliest stages of processing (Zhou, 1999).

Another advantage of using sol-gel methods are as it opposed to the more traditional processing techniques. This method approach is a cheap and low-temperature technique that allows for the fine control of the product’s chemical composition. Sol-gel derived material also can be used in various application, is not only in making film to make catalyst, but it also can be used in diverse application in optics, electronics, medicine and separation (chromatography) technology.

The synthesis of high purity products (submicron powders, nuclear fuels, electronic and ionic conductors, magnetic materials) because organometallic alkoxy precursors can be purified by distillation or recrystallization, the use of low temperature in the first step of the process, so that thermally labile compounds can be entrapped in the sol-gel matrix and the production of different physical forms (fibres, monoliths, coatings, powder) by modifying a few experimental parameters. The main drawbacks consist in possible high cost for the majority of alkoxide precursors and in the long processing steps (Zhou, 1999).

2.4 Production of Methanol

The main product yield from photo catalytic reduction process of CO_2 and NaOH by using TiO_2/Al_2O_3 is methanol. According to Inoue et. al., (1979), photo catalytic reduction of CO_2 in aqueous solutions will produce a mixture of formaldehyde, formic acid, methanol and methane using various wide-band-gap semiconductors such as tungsten trioxide (WO_3), titanium dioxide (TiO_2), zinc oxide (ZnO) , cadmium sulfide (CdS) , gallium phosphide (GaP) and silicon carbide (SiC).

Methanol as one of the main product of CO_2 photo-reduction can be transformed into other useful chemicals and used as fuel-like renewable energy. Many researchers has been reported that CO_2, in the present of water, can be photo-catalytically converted to methane, methanol and other hydrocarbons over TiO_2 or copper doped and mixed oxide-based photo catalyst. It is likely that the efficiency and selectivity of the product depend on the type of catalysts (Slamet et. al., 2009).

The effect of copper loading on methanol yields is shown in **Figure. 2.4**. The methanol yields increased with Cu loading, but then decreased when the Cu loading exceed 3 wt%. Evidently, more Cu loading can increase methanol yield because of the amount of active site. Catalyst with more than 3 wt% Cu loading cannot further increase the methanol yield due to its shading effects which are much higher, consequently reducing the photo exciting capacity of TiO_2 (Slamet et. al., 2005).

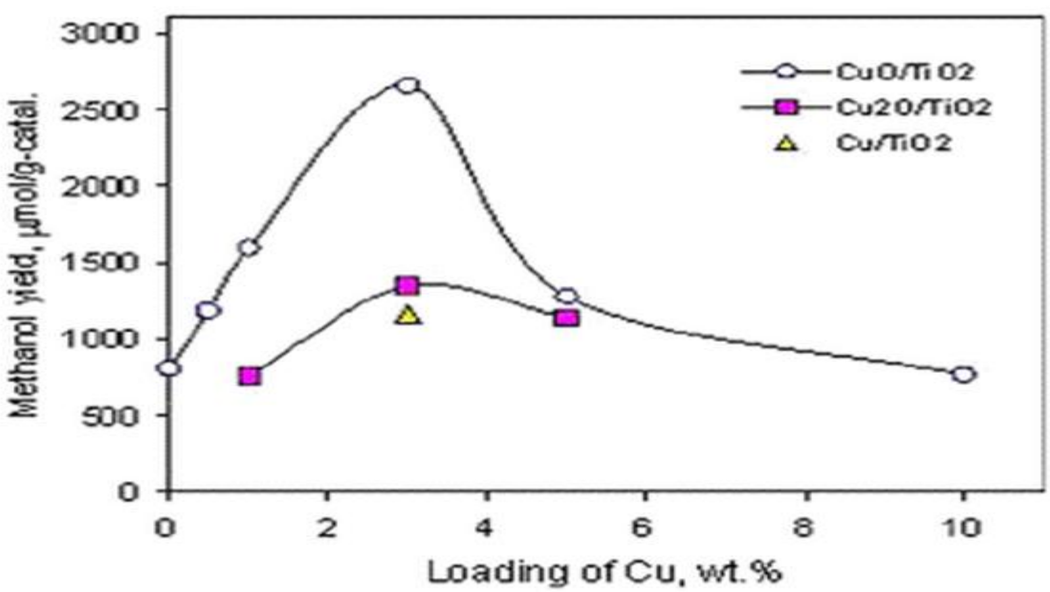

Figure 2.4: Effect on copper loading on TiO_2 catalyst on methanol yield (Slamet et. al., 2005).

The effect of temperature on methanol yields is shown in **Figure 2.5**. As can be seen from Figure 2.4 shows the methanol yield increased for higher reaction temperatures. The kinetic of CO_2 photo catalytic can be modelled with adsorption/desorption equilibrium of the various species involved in the reaction (Saladin et. al., 1997). At low temperatures surfaces coverage is high and product do not easily desorb. On the contrary, at high temperatures the adsorption of reactants becomes more important due to the scarcely covered surface and products readily desorbs and therefore activation energy is negative (Alxneit et. al., 1997).

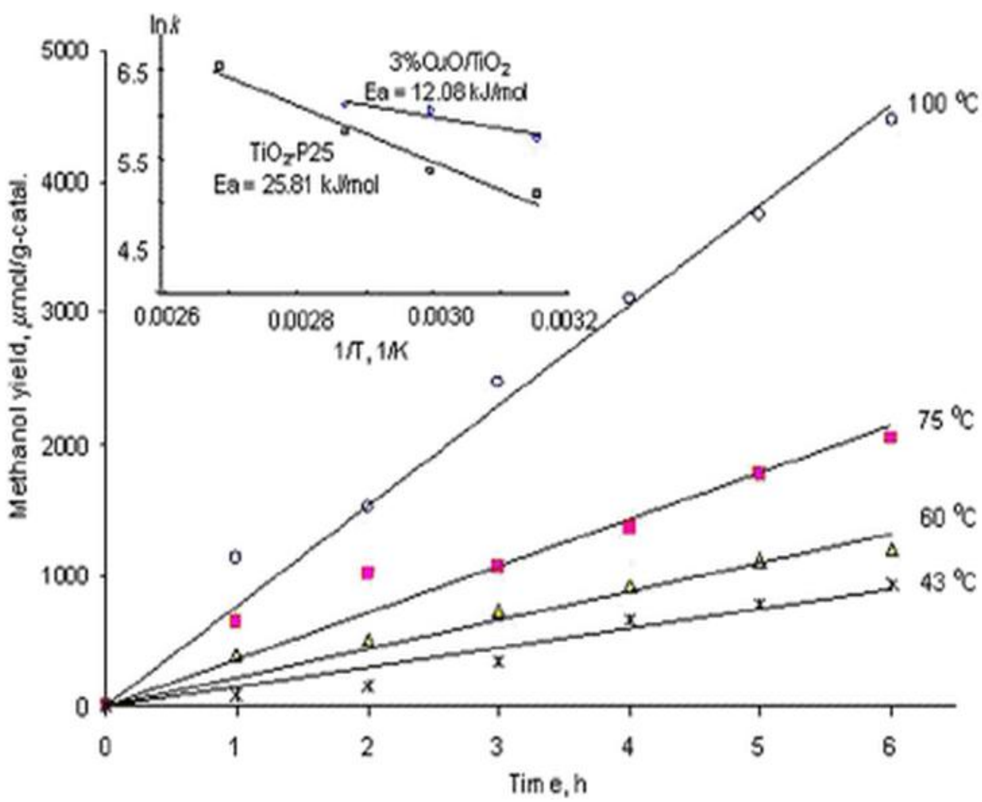

Figure 2.5: Temperature dependence of the methanol formation on TiO_2 (Slamet et. al., 2005).

Methanol has attractive features for use in transportation. It is a liquid fuel which can be blended with gasoline and ethanol and can be used with today's vehicle technology at minimal incremental cost (Bromberg and Chengs, 2010). Besides that, methanol is a high octane fuel with combustion characteristics that allow engines specifically designed for methanol fuel to match the best efficiencies of diesels while meeting current pollutant emission regulations. The most important is a safe fuel. The toxicity (mortality) is comparable to or better than gasoline. It also biodegrades quickly compared to petroleum fuels in case of a spill. Methanol can be produced from renewable biomass, and it also is an attractive greenhouse gas reduction transportation fuel option in the longer term (Bromberg and Cheng, 2010).

Methanol contain high octane rating (RON of 107 and MON of 92), which is making it a suitable gasoline substitute. It has a higher flame speed than gasoline, leading to higher efficiency as well as a higher latent heat of vaporization (3.7 times higher than gasoline). It means that the heat generated by the engine can be removed more effectively, making it possible to use air cooled engines. Methanol burns cleaner than gasoline and is safer in the case of a fire, but has only half the volumetric energy content of gasoline (George, 2005).

CHAPTER THREE

MATERIALS AND METHODS

3.0 Introduction

In order to study photo-catalysis process, preparation of catalyst was done first. In this study, methods that were used to prepare the catalyst were by sol-gel and hydrothermal method. The results from the photo-reduction process were analyzed using High Performance Liquid Chromatography (HPLC).

3.1 Chemicals and Materials

In this study, Titanium Dioxide (TiO_2) powder, Aluminum Oxide (Al_2O_3) powder, Sodium Hydroxide (NaOH) solution, Hydrochloric Acid (HCI), ethanol, distilled water and deionized water were used.

3.2 Preparation of Catalyst

3.2.1 Sol-Gel Method

In sol-gel method, $Ti(OC_3H_7)_4$ solution was prepared. The solution was done by adding 10 g of TiO_2 powder with 41 mL of ethanol and stirred for 30 minutes. The same procedure was used to prepare $Al(OC_3H_7)_3$ solution by using 1.04 g of Al_2O_3 powder and adding with 50mL of ethanol solution. The solution was added with 50 mL of water to be ethanol-water solution. Then, $Al(OC_3H_7)_3$ solution was mixed with $Ti(OC_3H_7)_4$ solution and stirred for 4 hours. Finally, $Al(OC_3H_7)_3$-$Ti(OC_3H_7)_4$ solution was produced.

In preparation of catalyst, a few drops of 1.0 M of sulphuric acid were added to adjust the pH of the solution to 3. Then, the solution was stirred for 4 hours before heated at constant temperature at 70 °C by using water bath. The reaction was maintained until the gel was formed and followed by ageing for 12 hours at room temperature. Then, the gel was washed with distilled water, before it was filtered using filter paper. The sample was dried for 12 hours at 102 °C in oven and calcined at 500 °C. Lastly, the sample was grinded into small particles and Al_2O_3-TiO_2 catalyst was produced.

3.2.2 Hydrothermal Method

By using the same amount of Al_2O_3 and TiO_2 powder in sol-gel method, the solutions of $Ti(OC_3H_7)_4$ and $Al(OC_3H_7)_3$ for hydrothermal method were prepared. The solution was stirred for 4 hours before it was put into stainless steel autoclave to carry out hydrothermal treatment at 121 ºC for 2 hours. Then, it was aged for 12 hours at room temperature and separated via centrifuge. The pH of the solution was adjusted until lower than 7 using 1.0 M of NaOH and 0.10 M of H_2SO_4. Deionised water was used to wash gently the solution to clean up the impurities. After filtration using filter paper, the small crystalline sample was dried in oven at 102 ºC for 12 hours before it was calcined in furnace at 500 ºC. After calcinations, the sample was grinded into small particles.

3.3 Photocatalytic Reduction of CO_2.

This study was carried out in a well-mixed heterogeneous batch type reactor. (Figure 3.1

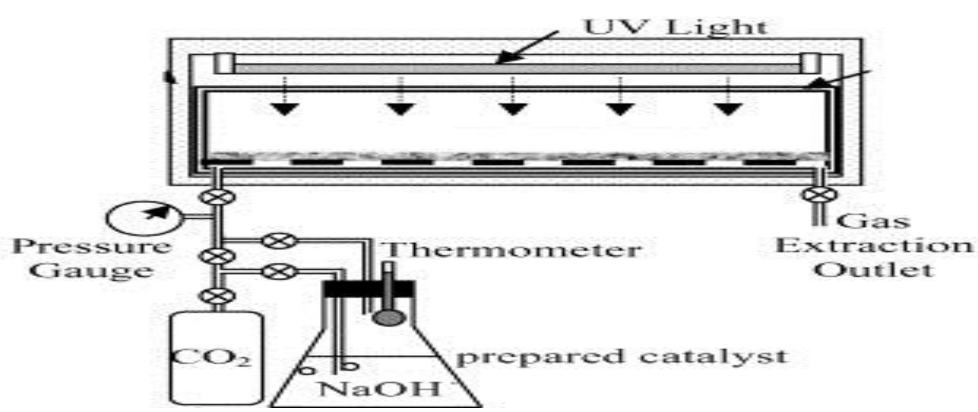

Figure 3.1: Schematic drawing of experimental set-up (Seng et. al., 2006).

In this study, irradiation process was carried out within 6 hours of reaction time. From cylindrical tank, CO_2 gas was flowed through NaOH solution in the batch reactor system. The rig was isolated with a pressure of approximately 2 psi above ambient pressure. After the whole rig was properly set-up, the rig and its contents was allowed to settle for 1 hour before the first gas sample was withdrawn. The UV light then was switched ON. The light was allowed to remain ON continuously for 6 hours. The liquid products accumulated inside the reactor was analysed by using High Performance Liquid Chromatography (HPLC). The liquid products accumulated inside the reactor was analysed by using High Performance Liquid Chromatography (HPLC).

3.3.1 Effect of Catalyst Dosage

Effect of catalyst dosage that prepared by using different methods were investigated in photo-reduction process (0.50, 1.0 , 1.50 and 2.0 g) with maintaining the parameters of 6 hours reaction time in 500 mL of NaOH solution.

3.4 Methanol Analysis

The total methanol concentration in aqueous phase was analysed by HPLC using a methanol (CH_3OH) standard solution. 1 litres of mobile phase liquid which is mixture of 400 mL acetonitrile and 600 mL ultrapure water also was prepared before running the analysis. The main product which was methanol was determined by referring the peak at methanol standard curve solution.

3.5 Flow Diagram of Experiment

Figure 3.2 shows the flow diagram of experiment.

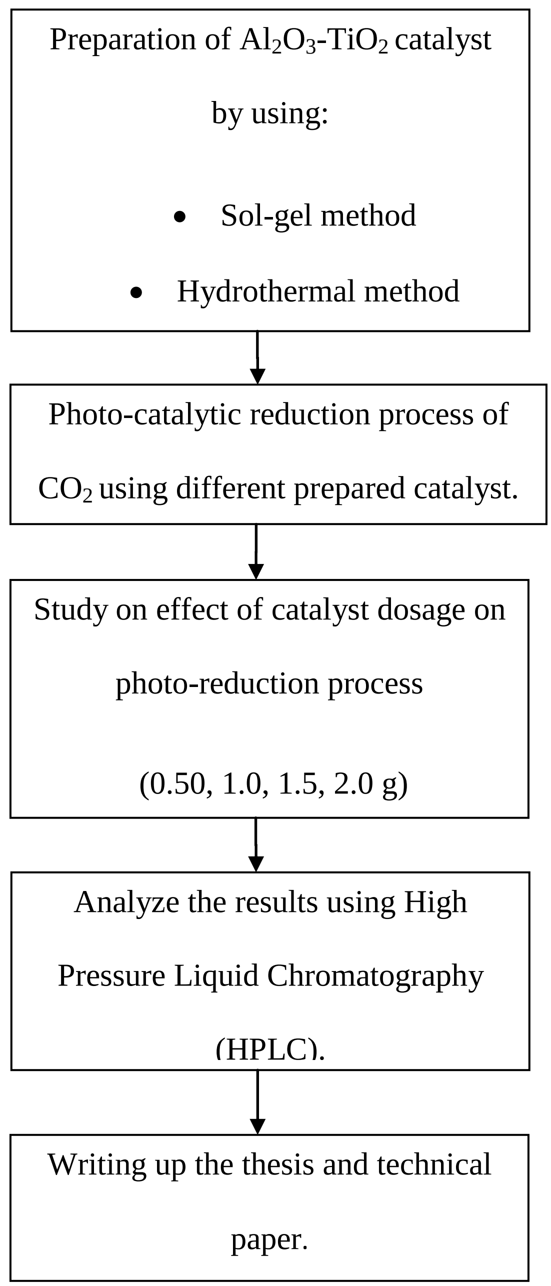

Figure 3.2 Flow diagram of experiment

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

Photo catalytic reduction of CO_2 using two different methods prepared which were hydrothermal method and sol-gel method has been carried on NaOH solution. **Figure 4.0** shows the methanol yield using different of TiO_2-Al_2O_3 catalyst dosages prepared by hydrothermal method

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4.1 Photocatalytic Process of CO_2

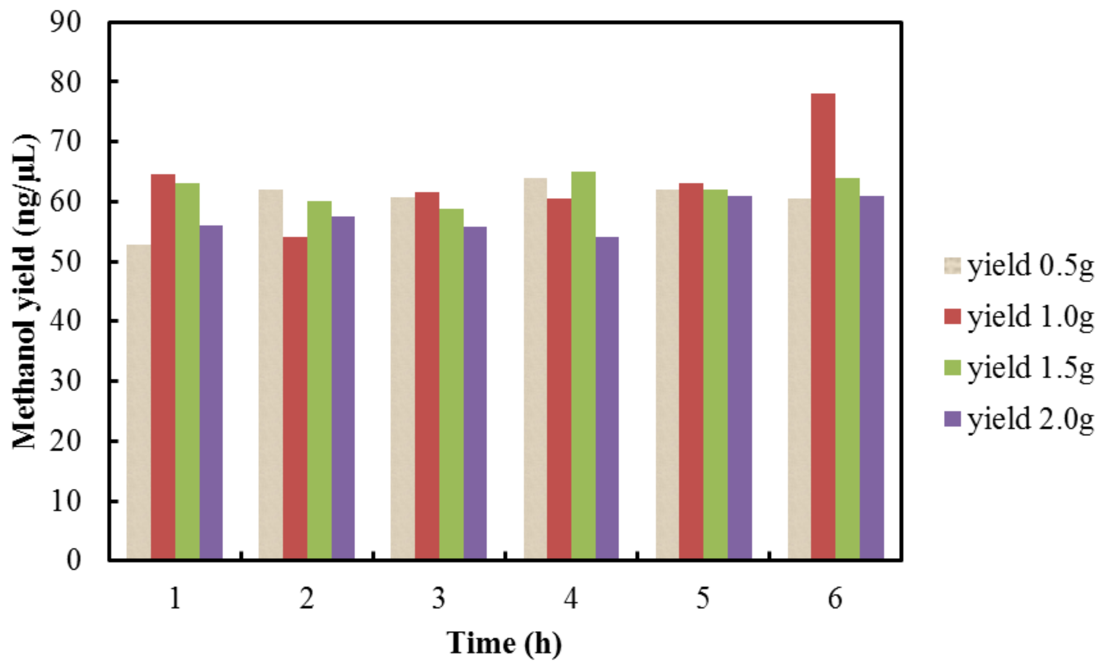

Figure 4.1: Production of methanol using catalyst prepared from hydrothermal method.

Figure 4.1 shows the production of methanol as a main product using TiO_2-Al_2O_3 catalyst that prepared from hydrothermal method. The photo catalytic process was study within 6 hours of reaction time. As we can see, the optimum dosage of 1.0 g catalyst produced maximum yield of methanol with 78 ng/µL. Whereas, the catalyst dosage of 2.0 g produces minimum yield of methanol after 6 hours.

Basically, the reaction efficiency increases with increasing the catalysis dosage and then stays nearly constant in a specific catalyst dosage (Marziyeh et. al., n.d). From the results, it indicates the yield using 0.50 g catalyst produces lower methanol yield compare to 1.0 g. This can be explained by increasing in dosage of catalyst will increase the amount of active site. This can be rationalise in term of increased of amount of active site on surface of photo catalyst particles and the light penetration of photo activating light into the suspension (Tae and Min, 2010). At low solute concentration, there are excess active sites, the balance between the opposing effects is evenly poised and change in suspension loading makes different effect of photo catalytic with little percentage. At high solute concentration availability of excess active sites outweighs the diminishing photo activated volume and significantly greater percentage is achieved at increasing TiO_2 dosage.

From the results also shows the methanol yield of 1.5 g and 2.0 g lower than using 1.0 g catalyst after 6 hours with 64 ng/μL and 61 ng/μL respectively. The decreased percentage of photo catalytic activity at higher catalyst dosage may be due to deactivation of activated molecules by collision with ground state molecules (Tae and Min, 2010). Hence, the optimum catalyst is needed to ensure total absorption of UV light photons for efficient photo mineralisation.

4.2 Sol-Gel Method

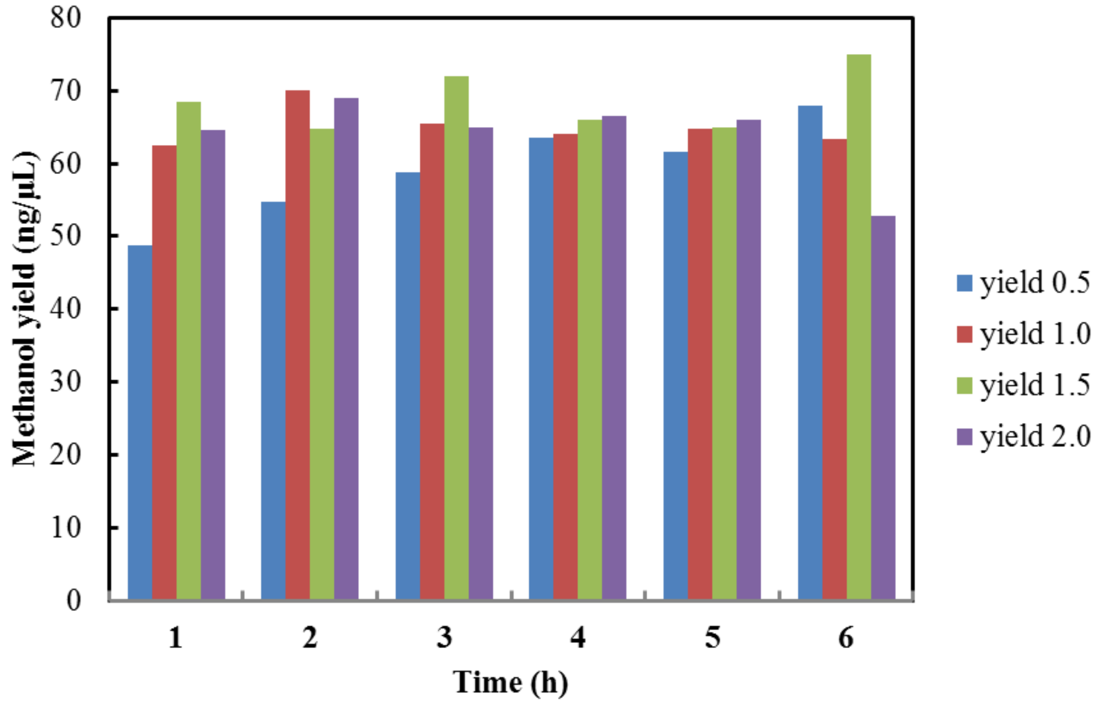

Figure 4.2: Production of methanol using catalyst prepared from sol-gel method.

Figure 4.2 shows the production of methanol using TiO_2-Al_2O_3 catalyst that prepared from sol-gel method. From the plot methanol yield vs reaction time, it is found that the optimum TiO_2-Al_2O_3 catalyst dosage is 1.5 g with 75 ng/µL maximum amount of methanol yield. This may be due to the fact that at high concentrations the degradation limiting factor is the available catalyst surface active sites concentration (Garriga et. al., 2005).

Hence, the catalyst surface features are very important as they determine the reaction mechanism. From the result after 1 hour, it shows that the lowest methanol yield from 0.50 g TiO_2-Al_2O_3 catalyst with 48.8 ng/µL. But after 3 hours, the methanol production is uniformly increased. The reason of this observation is thought to be the fact the catalyst surface is not saturated and so determinant. Thus, catalyst surface features and molecule-surface interaction affect photo catalytic activity rate at lower extent, being mainly determined by production of OH radical (Dona et. al., 2005).

After 6 hour of reaction, 2.0 catalyst dosage produces the lowest methanol compare to other dosages with 52.8 ng/μL .This can be explained on increasing in catalyst dosage, total active surface area is increases, hence availability of more active sites on catalyst surface. At the same time, due to an increasing in turbidity of the suspension with high dose of photo catalyst solution is agglomerate and non-there will be decrease in penetration of UV light and hence photo activated volume of suspension decreases (Kansal et. al., 2009).

4.3 Comparative Study of Catalyst from Different Preparation Methods.

When we compare the maximum yield of methanol produced by both catalyst prepared by different methods, we can see that hydrothermal method has the higher methanol yield compared to sol-gel method. Hydrothermal method produced 78 ng/μL amount of methanol compare to sol-gel which produced 75 ng/μL of yield. Both maximum yields were produced after 6 hours of reaction respectively with using different dosage of catalyst. 1.50 g dosage of catalyst that prepared from hydrothermal method is the optimum amount for photo reduction of CO_2 with achieved 78 ng/μL of methanol yield compared to sol-gel with only 1.0 g catalyst. This due to phase, particle size, and crystallinity can easily controlled by hydrothermal conditions.

Specific surface area also is one of the important parameter to enhance the photo catalytic activity properties. The ranges of specific area can widely depending upon the particle's size, shape and porosity of the sample (Lowell and Shields, 1998). From BET analysis, there are obvious differences the size obtained in the prepared catalyst using sol-gel and isothermal method. According to (Norhaszjana, 2012), in term of specific surface area, the modified TiO_2-Al_2O_3 powder catalyst prepared by hydrothermal methods shows higher surface area with 153.8599 m^2 /g compare the catalyst prepared by sol-gel method with 27.0919 m^2/g. From the results, the yield of methanol from catalyst prepared by hydrothermal method is higher than sol-gel method is due to size of specific surface area. So, the larger the specific area of prepared catalyst, the higher the yield of methanol from photo catalytic reduction process

BET analysis also is an alternative method to measure the pore size of the prepared catalyst. In photo catalytic process, the ability of the catalyst to absorb the UV light depends on pore size which is the key to have great photo induced properties of TiO_2. The determination of pore size is related to adsorption isotherm analysis. Adsorption theorem is the measurement of amount of the gas absorbed over a range of partial pressures (Brunauer et. al., 1940). The greater size of catalyst pore means the higher surface area that can absorbed higher amount of gas. Hence the photo catalytic process will increases as methanol yield. According to Murray et al., (2009), nanoporous catalysts have very versatile and rich surface composition, surface properties, which can be used for functional in increasing photo catalytic activity of TiO_2.

According to (Norhaszjana, 2012), hydrothermal method is the best method to be used to produce the TiO_2-Al_2O_3 catalyst than a sol-gel method as the characteristic of the samples produced enhanced the photo catalytic properties. Crystal growth is vital in controlling the phase, shape and size of photo catalyst. By rationally controlling crystal growth, the intrinsic surface atomic structure and resultant surface states of the derived photo catalyst can be tailored (Gang et. al., 2009).

Another important parameter is characterization of crystalline phase of TiO_2-Al_2O_3 catalyst. From XRD analysis, all the peaks exhibit the anatase of TiO_2. According to (Norhaszjana, 2012), XRD analysis of catalyst prepared by sol-gel method revealed that only one peak is at $2\theta = 25.680°$ with 265cps of intensity. The phase is amorphous structure might be due to the long heating process during preparing process of the sample.

Whereas, for hydrothermal method, the highest peak present at $2\theta=25.320°$ with 1118 cps of intensity, followed by peak at $2\theta=48.040°$ with 313 cps and the least peak present at $2\theta=38.000°$ .The crystalline phase of TiO_2-Al_2O_3 catalyst is show anatase phase (Norhaszjana, 2012). It is obvious that the crystalline of anatase phase or crystal growth is favoured for hydrothermal method which suitable to use for TiO_2.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Conclusions

Based on the overall experimental results obtained and discussed in chapter four, the summaries are made as listed below:

The aim of this study was to determine the effect of catalyst dosage on photo catalytic activity has been achieved in the photo reduction process by using sol-gel and hydrothermal method. Experiment results demonstrated that hydrothermal method was a promising technique for preparing TiO_2-Al_2O_3 photo catalyst as it fulfilled some the requirement properties to enhance photo catalytic activity of TiO_2 photo catalytic process.

Based on effect of catalyst dosage on methanol yield in photo catalytic reduction process, the optimum dosage of TiO_2-Al_2O_3 catalyst for hydrothermal method is 1.0 g. It was produced the maximum yield of methanol with 78 ng/µL. Other than that, based on TiO_2-Al_2O_3 catalyst prepared by sol-gel method the optimum dosage can be used is 1.5 g which also produced maximum yield of methanol with 75 ng/µL.

Due to the maximum yield produced from catalyst that prepared from hydrothermal method compared to sol-gel method, it was proved that hydrothermal method is the best method in production of methanol compare to sol-gel method

5.1 Recommendations

As recommendations for future study:

- It is recommended to study different method of preparation of catalyst such as ion exchange method and impregnation method to investigate the effectiveness of the catalyst
- It is recommended to study different parameters such as temperature of calcination, pressure of CO_2 supply, and temperature of hydrothermal treatment.

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APPENDICES

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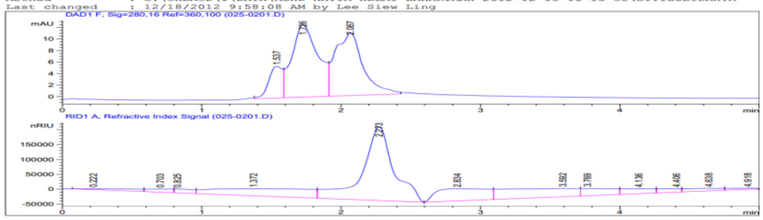


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3	0.825	VV	0.1418	1.19447e5	1.24961e4	1.3855
4	1.372	VV	0.6429	1.20132e6	2.38877e4	13.9345
5	2.273	VV	0.2206	3.88158e6	2.49173e5	45.0236
6	2.834	VV	0.3682	1.03263e6	4.08685e4	11.9778
7	3.592	VV	0.5418	1.12833e6	2.77248e4	13.0879
8	3.769	VV	0.2232	3.73992e5	2.42466e4	4.3380
9	4.136	VV	0.2224	2.62510e5	1.66879e4	3.0449
10	4.406	VV	0.1648	1.37556e5	1.17401e4	1.5956
11	4.638	VV	0.2694	1.61231e5	8395.31055	1.8702
12	4.918	VBA	0.2507	5.80456e4	3332.73535	0.6733
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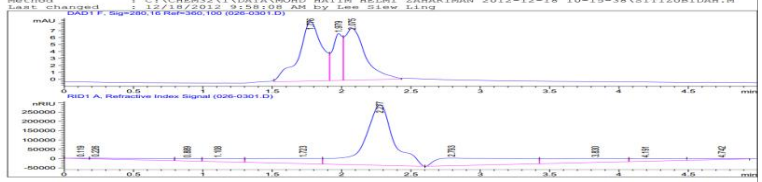


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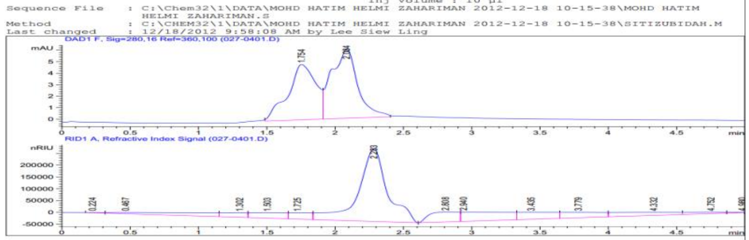
3	0.889	VV	0.1688	1.54973e5	1.30527e4	1.6766
4	1.108	VV	0.2647	3.15141e5	1.65967e4	3.4094
5	1.723	VV	0.4757	8.36091e5	2.74954e4	9.0454
6	2.277	VV	0.2063	4.74622e6	3.26545e5	51.3481
7	2.793	VV	0.5214	1.60959e6	4.09342e4	17.4137
8	3.830	VV	0.5372	8.47737e5	2.09355e4	9.1714
9	4.191	VV	0.2888	3.14995e5	1.43345e4	3.4078
10	4.742	VV	0.3925	1.36884e5	4905.77734	1.4809
Totals :				9.24322e6	4.70922e5	

```
=====================================================================
                        *** End of Report ***
```

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\027-0401.D
Sample Name: HD-0.5-03

Acq. Operator : Lee Siew Ling Seq. Line : 4
Acq. Instrument : Instrument 1 Location : Vial 27
Injection Date : 12/18/2012 10:39:26 AM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

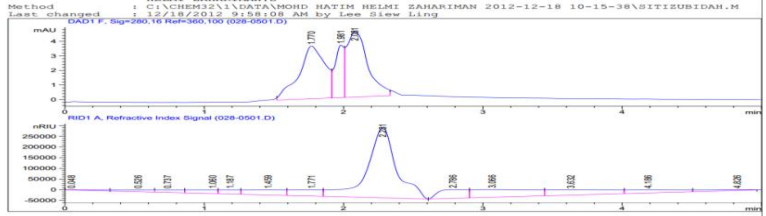
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\027-0401.D
Sample Name: HD-0.5-03

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.224	BV	0.1554	1.08218e4	943.65259	0.1187
2	0.467	VV	1.0938	4.74912e5	5361.76270	5.2094
3	1.302	VV	0.1740	2.35119e5	1.93769e4	2.5791
4	1.503	VV	0.2494	4.09470e5	2.31725e4	4.4916
5	1.725	VV	0.1561	2.95016e5	2.68868e4	3.2361
6	2.283	VV	0.2120	4.58200e6	3.08838e5	50.2612
7	2.808	VV	0.2309	6.29814e5	4.20504e4	6.9086
8	2.940	VV	0.2912	8.76638e5	3.91874e4	9.6161
9	3.435	VV	0.2710	5.39858e5	2.96181e4	5.9218
10	3.779	VV	0.2808	4.71903e5	2.31731e4	5.1764
11	4.332	VV	0.4444	4.54141e5	1.30670e4	4.9816
12	4.752	VV	0.2999	1.20043e5	5501.92529	1.3168
13	4.980	VBA	0.2101	1.66440e4	1320.62244	0.1826
Totals :				9.11638e6	5.38498e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\028-0501.D
Sample Name: HD-0.5-04

Acq. Operator : Lee Siew Ling Seq. Line : 5
Acq. Instrument : Instrument 1 Location : Vial 28
Injection Date : 12/18/2012 10:46:46 AM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\028-0501.D
Sample Name: HD-0.5-04

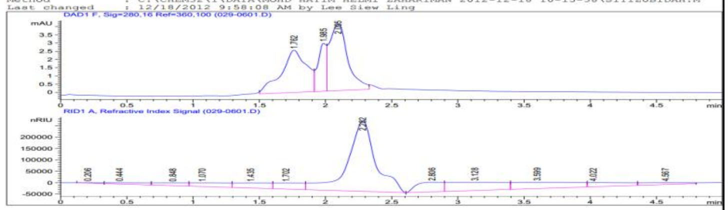
Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.048	BV	0.9321	4.73475e4	846.56842	0.4993
2	0.526	VV	0.2445	1.44050e5	8349.97168	1.5191
3	0.737	VV	0.1841	1.55156e5	1.17648e4	1.6362
4	1.060	VV	0.1796	2.26443e5	1.71944e4	2.3880
5	1.187	VV	0.1377	1.88527e5	1.93082e4	1.9882
6	1.459	VV	0.2763	4.68346e5	2.43481e4	4.9391
7	1.771	VV	0.2247	4.49229e5	2.95765e4	4.7375
8	2.281	VV	0.2087	4.80233e6	3.29903e5	50.6444
9	2.786	VV	0.2206	5.89462e5	4.12807e4	6.2164
10	3.066	VV	0.4008	1.08897e6	3.61852e4	11.4841
11	3.632	VV	0.4370	7.92150e5	2.51186e4	8.3539
12	4.186	VV	0.3725	3.91945e5	1.49665e4	4.1334
13	4.826	VV	0.4834	1.38488e5	3800.67896	1.4605
Totals :				9.48244e6	5.62643e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\029-0601.D
Sample Name: HD-0.5-05

Acq. Operator : Lee Siew Ling — Seq. Line : 6
Acq. Instrument : Instrument 1 — Location : Vial 29
Injection Date : 12/18/2012 10:54:06 AM — Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

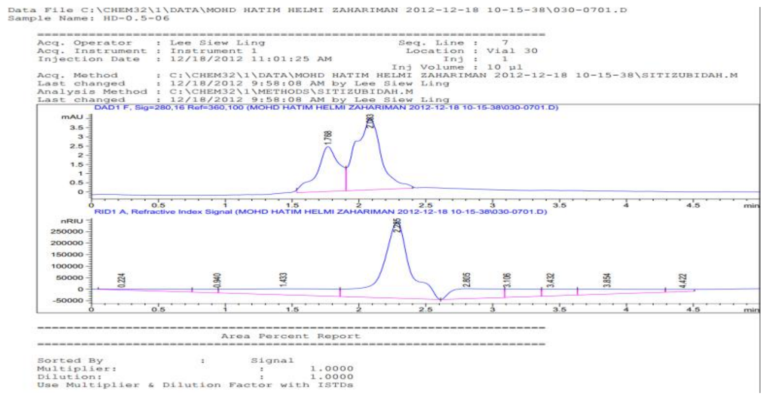
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\029-0601.D
Sample Name: HD-0.5-05

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.206	BV	0.1923	2.14805e4	1525.91809	0.2351
2	0.444	VV	0.3480	1.35526e5	5498.49414	1.4830
3	0.848	VV	0.2388	2.00364e5	1.22185e4	2.1925
4	1.070	VV	0.3046	3.28983e5	1.60039e4	3.6000
5	1.435	VV	0.2572	4.08496e5	2.20453e4	4.4701
6	1.702	VV	0.2147	4.00910e5	2.65981e4	4.3870
7	2.282	VV	0.2084	4.56505e6	3.10283e5	49.9541
8	2.806	VV	0.2210	5.86183e5	4.20262e4	6.4144
9	3.128	VV	0.3907	1.05614e6	3.59038e4	11.5571
10	3.599	VV	0.4283	8.79631e5	2.71011e4	9.6256
11	4.022	VV	0.2563	3.52515e5	1.87318e4	3.8575
12	4.567	VV	0.3530	2.03213e5	8105.14111	2.2237
Totals :				9.13850e6	5.26042e5	

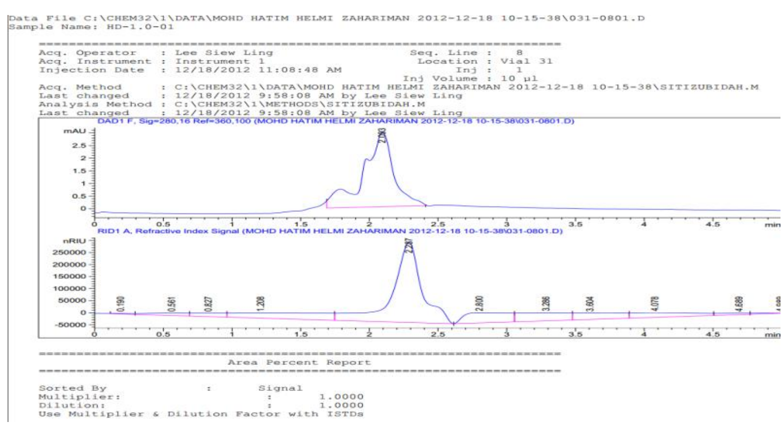
*** End of Report ***



Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\030-0701.D
Sample Name: HD-0.5-06

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.224	BV	0.8532	2.78952e5	3923.87427	2.9371
2	0.940	VV	0.1490	1.66418e5	1.59561e4	1.7522
3	1.433	VV	0.6454	1.36232e6	2.60202e4	14.3442
4	2.285	VV	0.2044	4.74816e6	3.30454e5	49.9942
5	2.805	VV	0.3370	1.03957e6	4.31893e4	10.9459
6	3.106	VV	0.2564	5.62297e5	3.65474e4	5.9205
7	3.432	VV	0.2149	4.56300e5	2.98803e4	4.8045
8	3.854	VV	0.4598	7.52638e5	2.18718e4	7.9247
9	4.422	VV	0.1921	1.30749e5	9680.05664	1.3767
Totals :				9.49741e6	5.17523e5	

*** End of Report ***



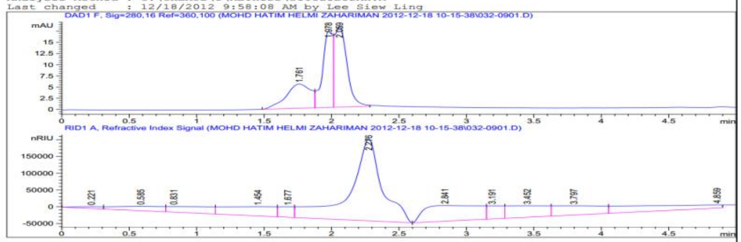
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\031-0801.D
Sample Name: HD-1.0-01

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.827	VV	0.2393	2.35204e5	1.44710e4	2.4372
4	1.208	VV	0.6684	1.09618e6	2.11890e4	11.3588
5	2.287	VV	0.2082	4.97744e6	3.34453e5	51.5771
6	2.800	VV	0.3180	9.41234e5	4.26345e4	9.7532
7	3.286	VV	0.3573	8.29544e5	3.26019e4	8.5959
8	3.604	VV	0.3310	6.16256e5	2.65773e4	6.3858
9	4.078	VV	0.4061	5.68084e5	1.80489e4	5.8866
10	4.689	VV	0.2443	1.09608e5	6159.98486	1.1358
11	4.989	VBA	0.4729	3.99348e4	1407.31030	0.4138
Totals :				9.65047e6	5.10491e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\032-0901.D
Sample Name: HD-1.0-02

Acq. Operator : Lee Siew Ling   Seq. Line : 9
Acq. Instrument : Instrument 1   Location : Vial 32
Injection Date : 12/18/2012 11:16:08 AM   Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\032-0901.D
Sample Name: HD-1.0-02

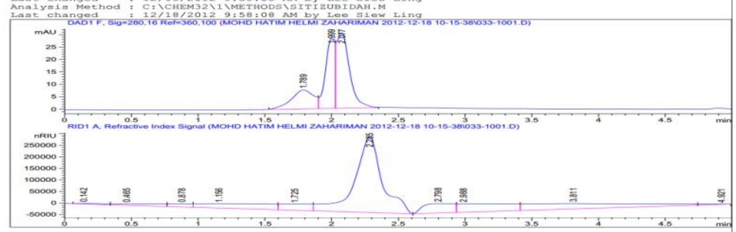
Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.221	BV	0.2223	7.05422e4	5288.96631	0.7401
2	0.585	VV	0.3586	3.18965e5	1.28555e4	3.3465
3	0.831	VV	0.3660	4.10055e5	1.65978e4	4.3022
4	1.454	VV	0.3412	7.08035e5	2.75200e4	7.4285
5	1.677	VV	0.1102	2.37907e5	3.13157e4	2.4960
6	2.276	VV	0.2257	4.04385e6	2.44053e5	42.4266
7	2.841	VV	0.4046	1.31254e6	4.68553e4	13.7707
8	3.191	VV	0.1159	3.14344e5	3.88727e4	3.2980
9	3.452	VV	0.2922	6.95101e5	3.40485e4	7.2928
10	3.797	VV	0.3473	6.65986e5	2.72975e4	6.9873
11	4.859	VV	1.0051	7.54062e5	9145.85547	7.9114
Totals :				9.53139e6	4.93850e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\033-1001.D
Sample Name: HD-1.0-03

Acq. Operator : Lee Siew Ling   Seq. Line : 10
Acq. Instrument : Instrument 1   Location : Vial 33
Injection Date : 12/18/2012 11:23:28 AM   Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\033-1001.D
Sample Name: HD-1.0-03

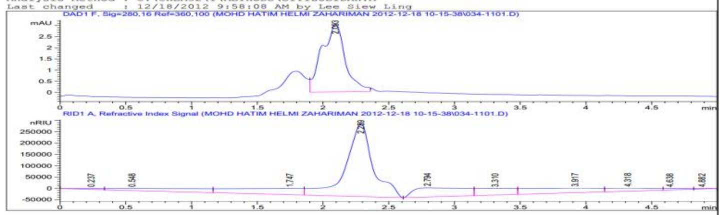
Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.142	BV	0.2984	5.11425e4	2378.51050	0.5514
2	0.465	VV	0.4020	2.11536e5	7004.50000	2.2806
3	0.878	VV	0.1641	1.56998e5	1.36811e4	1.6926
4	1.156	VV	0.5404	7.70209e5	1.89788e4	8.3039
5	1.725	VV	0.2295	4.16773e5	2.64078e4	4.4934
6	2.285	VV	0.2012	4.69140e6	3.28492e5	50.5796
7	2.798	VV	0.2403	6.52112e5	4.08361e4	7.0306
8	2.988	VV	0.3382	9.40446e5	3.69253e4	10.1393
9	3.811	VV	0.7731	1.35371e6	2.29988e4	14.5948
10	4.921	VBA	0.3120	3.09539e4	1311.99426	0.3337
Totals :				9.27528e6	4.99015e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\034-1101.D
Sample Name: HD-1.0-04

Acq. Operator	: Lee Siew Ling	Seq. Line :	11
Acq. Instrument	: Instrument 1	Location :	Vial 34
Injection Date	: 12/18/2012 11:30:48 AM	Inj :	1
		Inj Volume :	10 µl
Acq. Method	: C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M		
Last changed	: 12/18/2012 9:58:08 AM by Lee Siew Ling		
Analysis Method	: C:\CHEM32\1\METHODS\SITIZUBIDAH.M		
Last changed	: 12/18/2012 9:58:08 AM by Lee Siew Ling		



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

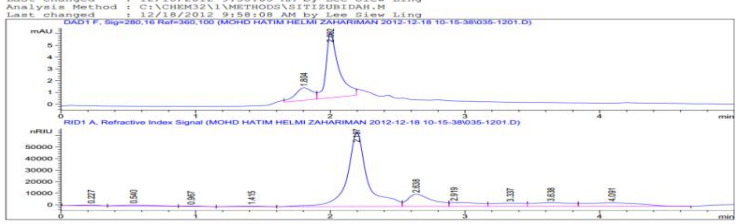
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\034-1101.D
Sample Name: HD-1.0-04

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.747	VV	0.4719	9.61844e5	2.74208e4	10.5641
4	2.289	VV	0.2020	4.62639e6	3.22386e5	50.8127
5	2.794	VV	0.3659	1.06644e6	4.01712e4	11.7129
6	3.310	VV	0.2842	5.75253e5	2.91590e4	6.3181
7	3.917	VV	0.5552	8.28111e5	1.96147e4	9.0953
8	4.318	VV	0.3525	3.12179e5	1.28540e4	3.4287
9	4.638	VV	0.1746	7.43941e4	6499.89453	0.8171
10	4.882	VBA	0.1378	1.83057e4	2213.42041	0.2011
Totals :				9.10480e6	4.73968e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\035-1201.D
Sample Name: HD-1.0-05

Acq. Operator	: Lee Siew Ling	Seq. Line :	12
Acq. Instrument	: Instrument 1	Location :	Vial 35
Injection Date	: 12/18/2012 11:38:09 AM	Inj :	1
		Inj Volume :	10 µl
Acq. Method	: C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M		
Last changed	: 12/18/2012 9:58:08 AM by Lee Siew Ling		
Analysis Method	: C:\CHEM32\1\METHODS\SITIZUBIDAH.M		
Last changed	: 12/18/2012 9:58:08 AM by Lee Siew Ling		



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

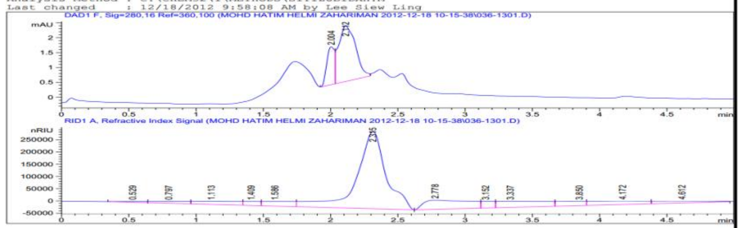
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\035-1201.D
Sample Name: HD-1.0-05

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.227	BV	0.1726	6720.10254	626.81500	0.6140
2	0.540	VV	0.3046	1.73509e4	875.68695	1.5854
3	0.967	VV	0.1744	4396.83643	411.22003	0.4018
4	1.415	VV	0.2253	8237.91797	553.94293	0.7527
5	2.197	VV	0.1455	6.69229e5	6.41469e4	61.1497
6	2.638	VV	0.1857	1.35700e5	1.06283e4	12.3993
7	2.919	VV	0.1960	5.29790e4	3500.49878	4.8409
8	3.337	VV	0.2449	4.74750e4	2868.68018	4.3379
9	3.638	VV	0.2894	6.50826e4	3138.68433	5.9468
10	4.091	VV	0.3964	8.72400e4	2991.21436	7.9714
Totals :				1.09441e6	8.97419e4	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\036-1301.D
Sample Name: HD-1.0-06

Acq. Operator : Lee Siew Ling Seq. Line : 13
Acq. Instrument : Instrument 1 Location : Vial 36
Injection Date : 12/18/2012 11:45:28 AM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\036-1301.D
Sample Name: HD-1.0-06

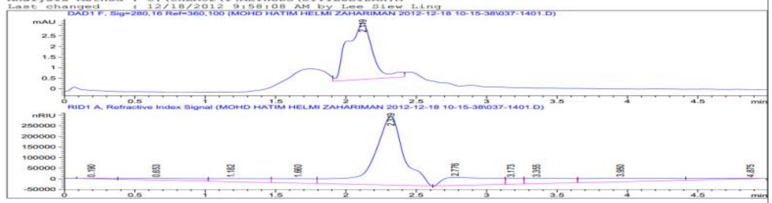
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.529	BV	0.1984	4.75846e4	3480.59692	0.5793
2	0.797	VV	0.2547	1.45834e5	7729.93018	1.7754
3	1.113	VV	0.3295	2.98726e5	1.24551e4	3.6367
4	1.409	VV	0.1173	1.33731e5	1.63053e4	1.6281
5	1.586	VV	0.2362	3.02690e5	1.89373e4	3.6850
6	2.315	VV	0.2131	4.77355e6	3.15674e5	58.1135
7	2.778	VV	0.3344	8.70133e5	3.70665e4	10.5931
8	3.152	VV	0.0932	1.76597e5	2.71388e4	2.1499
9	3.337	VV	0.3255	6.05896e5	2.46617e4	7.3762
10	3.850	VV	0.2013	2.55059e5	1.73990e4	3.1051
11	4.172	VV	0.4016	3.91304e5	1.33847e4	4.7638
12	4.612	VV	0.4193	2.13078e5	7186.71436	2.5940
Totals :				8.21419e6	5.01420e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\037-1401.D
Sample Name: HD-1.5-01

===

Acq. Operator : Lee Siew Ling Seq. Line : 14
Acq. Instrument : Instrument 1 Location : Vial 37
Injection Date : 12/18/2012 11:52:48 AM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



===
Area Percent Report
===

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\037-1401.D
Sample Name: HD-1.5-01

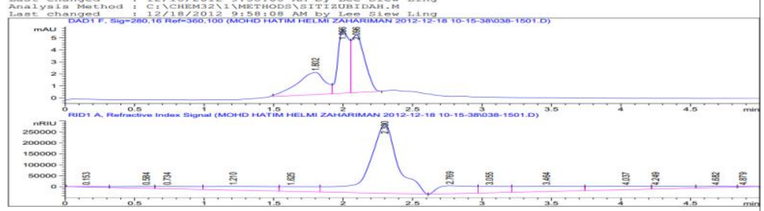
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.182	VV	0.3730	4.05970e5	1.43617e4	4.8175
4	1.660	VV	0.2789	3.98829e5	2.08889e4	4.7328
5	2.319	VV	0.2120	4.80273e6	3.23661e5	56.9928
6	2.776	VV	0.3371	9.34607e5	3.82278e4	11.0908
7	3.173	VV	0.1108	2.14077e5	2.73247e4	2.5404
8	3.355	VV	0.2784	5.22775e5	2.45726e4	6.2036
9	3.950	VV	0.5478	6.61602e5	1.60510e4	7.8511
10	4.875	VBA	1.3264	1.44324e5	1813.47778	1.7127
Totals :				8.42690e6	4.76297e5	

===
*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\038-1501.D
Sample Name: HD-1.5-02

===

Acq. Operator : Lee Siew Ling Seq. Line : 15
Acq. Instrument : Instrument 1 Location : Vial 38
Injection Date : 12/18/2012 12:00:08 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



===
Area Percent Report
===

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\038-1501.D
Sample Name: HD-1.5-02

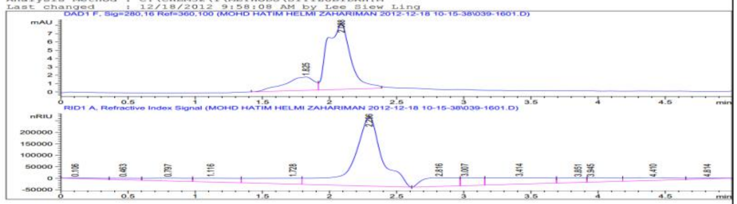
Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.153	BV	0.2787	4.11979e4	2180.50806	0.4875
2	0.584	VV	0.2432	1.33729e5	8540.74902	1.5826
3	0.734	VV	0.3071	2.39454e5	1.05876e4	2.8337
4	1.210	VV	0.4930	5.73401e5	1.69946e4	6.7856
5	1.625	VV	0.2682	3.92326e5	2.15841e4	4.6428
6	2.300	VV	0.2021	4.51694e6	3.14604e5	53.4537
7	2.769	VV	0.2506	6.30465e5	3.66008e4	7.4610
8	3.055	VV	0.2024	4.17238e5	2.93750e4	4.9376
9	3.464	VV	0.4118	7.34945e5	2.36774e4	8.6974
10	4.037	VV	0.4478	4.63684e5	1.55257e4	5.4873
11	4.249	VV	0.2050	1.92172e5	1.20829e4	2.2742
12	4.682	VV	0.2347	9.80956e4	5844.97510	1.1609
13	4.879	VBA	0.1158	1.65462e4	2381.81567	0.1958
Totals :				8.45019e6	4.99980e5	

===
*** End of Report ***

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\039-1601.D
Sample Name: HD-1.5-03

=====================================================================
Acq. Operator   : Lee Siew Ling                   Seq. Line :  16
Acq. Instrument : Instrument 1                     Location : Vial 39
Injection Date  : 12/18/2012 12:07:28 PM                Inj :  1
                                                 Inj Volume : 10 µl
Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
```

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=====================================================================
                        Area Percent Report
=====================================================================

Sorted By              :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

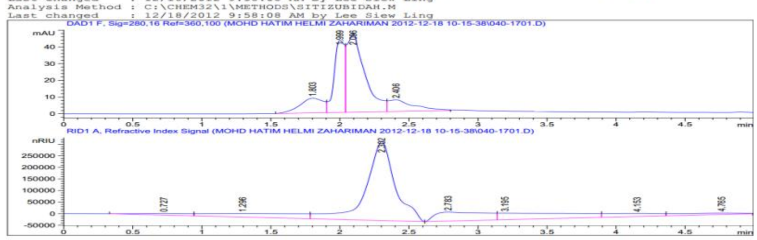
```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\039-1601.D
Sample Name: HD-1.5-03
```

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.106	BV	0.5118	5.97748e4	1946.48035	0.6940
2	0.463	VV	0.2053	9.67609e4	6530.28125	1.1234
3	0.797	VV	0.3099	2.61975e5	1.19448e4	3.0415
4	1.116	VV	0.3148	3.68346e5	1.64806e4	4.2764
5	1.728	VV	0.3305	6.25123e5	2.55729e4	7.2576
6	2.296	VV	0.2076	4.43608e6	2.99169e5	51.5019
7	2.816	VV	0.2742	6.75279e5	3.76152e4	7.8399
8	3.007	VV	0.1565	3.59210e5	3.37697e4	4.1704
9	3.414	VV	0.4388	8.61800e5	2.76847e4	10.0053
10	3.851	VV	0.1926	2.73008e5	1.93568e4	3.1696
11	3.945	VV	0.1995	2.54821e5	1.77953e4	2.9584
12	4.410	VV	0.3813	2.80571e5	1.04862e4	3.2574
13	4.814	VBA	0.2531	6.06740e4	3338.01855	0.7044
Totals :				8.61342e6	5.11690e5	

```
=====================================================================
                        *** End of Report ***
```

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\040-1701.D
Sample Name: HD-1.5-04

=====================================================================
Acq. Operator   : Lee Siew Ling                   Seq. Line :  17
Acq. Instrument : Instrument 1                     Location : Vial 40
Injection Date  : 12/18/2012 12:14:49 PM                Inj :  1
                                                 Inj Volume : 10 µl
Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
```




```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By              :      Signal
Multiplier:                   :      1.0000
Dilution:                     :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\040-1701.D
Sample Name: HD-1.5-04
```

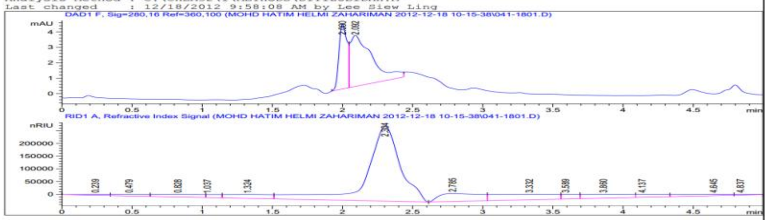
Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.727	BV	0.3928	1.99045e5	7421.26563	2.3066
2	1.296	VV	0.6716	8.19244e5	1.58630e4	9.4935
3	2.302	VV	0.2067	4.97466e6	3.41485e5	57.6470
4	2.783	VV	0.3476	9.73420e5	3.86867e4	11.2801
5	3.195	VV	0.4592	1.04009e6	2.82864e4	12.0527
6	4.153	VV	0.3736	3.85554e5	1.36133e4	4.4679
7	4.765	VBA	0.5572	2.37512e5	5779.70117	2.7523
Totals :				8.62952e6	4.51135e5	

```
=====================================================================
                        *** End of Report ***
```

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\041-1801.D
Sample Name: HD-1.5-05

    =====================================================================
    Acq. Operator   : Lee Siew Ling                         Seq. Line :   18
    Acq. Instrument : Instrument 1                           Location : Vial 41
    Injection Date  : 12/18/2012 12:22:12 PM                     Inj :   1
                                                         Inj Volume : 10 µl
    Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
    Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
    Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
    Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
```




```
    =====================================================================
                           Area Percent Report
    =====================================================================

    Sorted By             :      Signal
    Multiplier:                  :      1.0000
    Dilution:                    :      1.0000
    Use Multiplier & Dilution Factor with ISTDs
```

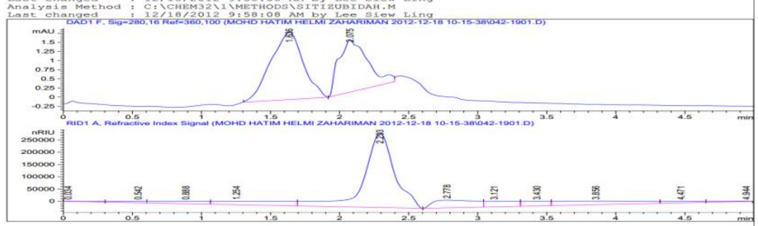
```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\041-1801.D
Sample Name: HD-1.5-05
```

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.239	BV	0.2052	4.56264e4	3159.50830	0.5882
2	0.479	VV	0.2363	9.67988e4	5720.39258	1.2480
3	0.828	VV	0.3298	2.21536e5	9597.32520	2.8562
4	1.037	VV	0.1228	8.27284e4	1.12244e4	1.0666
5	1.324	VV	0.3128	3.20640e5	1.46975e4	4.1339
6	2.304	VV	0.2333	4.83622e6	2.93424e5	62.3522
7	2.785	VV	0.2886	6.25578e5	3.14053e4	8.0654
8	3.332	VV	0.4032	6.92018e5	2.17720e4	8.9220
9	3.589	VV	0.1147	1.46651e5	1.83769e4	1.8907
10	3.860	VV	0.3336	3.48074e5	1.53540e4	4.4876
11	4.137	VV	0.1819	1.44607e5	1.11253e4	1.8644
12	4.645	VV	0.4233	1.68681e5	5625.64014	2.1748
13	4.837	VBA	0.1336	2.71415e4	3063.53491	0.3499
Totals :				7.75630e6	4.44546e5	

```
=====================================================================
                        *** End of Report ***
```

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\042-1901.D
Sample Name: HD-1.5-06

    =====================================================================
    Acq. Operator   : Lee Siew Ling                         Seq. Line :   19
    Acq. Instrument : Instrument 1                           Location : Vial 42
    Injection Date  : 12/18/2012 12:29:31 PM                     Inj :   1
                                                         Inj Volume : 10 µl
    Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
    Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
    Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
    Last changed    : 12/18/2012 9:58:08 AM by Lee Siew Ling
```




```
    =====================================================================
                           Area Percent Report
    =====================================================================

    Sorted By             :      Signal
    Multiplier:                  :      1.0000
    Dilution:                    :      1.0000
    Use Multiplier & Dilution Factor with ISTDs
```

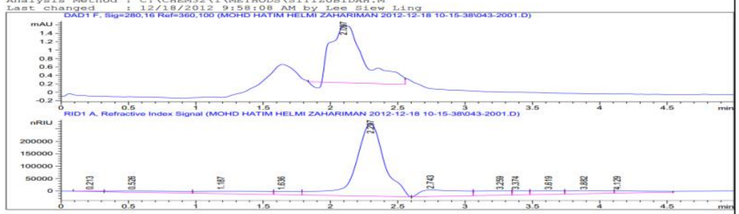
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\042-1901.D
Sample Name: HD-1.5-06

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.034	BV	0.9124	2.37018e4	432.97522	0.3093
2	0.542	VV	0.2125	8.08590e4	5572.02490	1.0552
3	0.888	VV	0.3326	2.50541e5	9950.86035	3.2696
4	1.254	VV	0.5272	5.60495e5	1.36948e4	7.3146
5	2.293	VV	0.2244	4.65361e6	3.03266e5	60.7307
6	2.778	VV	0.3088	6.70116e5	3.17599e4	8.7452
7	3.121	VV	0.2122	3.62224e5	2.34977e4	4.7271
8	3.430	VV	0.1933	2.59769e5	1.93513e4	3.3901
9	3.856	VV	0.5740	6.34328e5	1.47208e4	8.2781
10	4.471	VV	0.2738	1.22288e5	6491.94922	1.5959
11	4.944	VBA	0.7149	4.47645e4	1043.63611	0.5842
Totals :				7.66269e6	4.29782e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\043-2001.D
Sample Name: HD-2.0-01

Acq. Operator : Lee Siew Ling Seq. Line : 20
Acq. Instrument : Instrument 1 Location : Vial 43
Injection Date : 12/18/2012 12:36:51 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

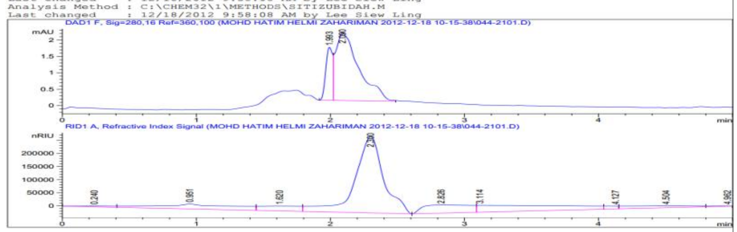
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\043-2001.D
Sample Name: HD-2.0-01

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.187	VV	0.5028	3.83917e5	1.00290e4	5.7378
4	1.636	VV	0.1887	1.76207e5	1.35295e4	2.6335
5	2.297	VV	0.2165	4.28301e6	2.92042e5	64.0111
6	2.743	VV	0.3131	5.54450e5	2.58237e4	8.2865
7	3.259	VV	0.2595	3.03852e5	1.72487e4	4.5412
8	3.374	VV	0.1125	1.25407e5	1.60904e4	1.8742
9	3.619	VV	0.2141	2.14452e5	1.39359e4	3.2051
10	3.882	VV	0.2881	2.41444e5	1.15016e4	3.6085
11	4.129	VV	0.2659	1.69123e5	8860.43848	2.5276
Totals :				6.69104e6	4.15776e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\044-2101.D
Sample Name: HD-2.0-02

Acq. Operator : Lee Siew Ling Seq. Line : 21
Acq. Instrument : Instrument 1 Location : Vial 44
Injection Date : 12/18/2012 12:44:09 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

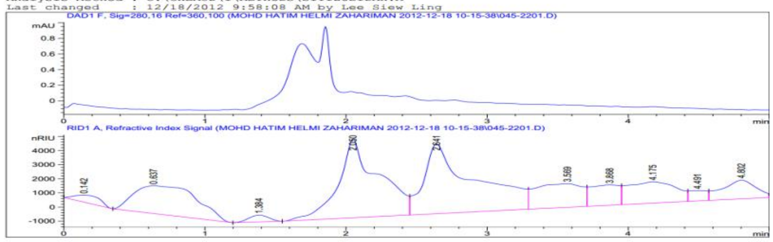
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\044-2101.D
Sample Name: HD-2.0-02

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.240	BV	0.2519	6.03508e4	3086.20068	0.7835
2	0.951	VV	0.4890	7.31466e5	1.84301e4	9.4961
3	1.620	VV	0.2928	3.76349e5	1.83883e4	4.8859
4	2.300	VV	0.2126	4.32586e6	2.90543e5	56.1594
5	2.826	VV	0.3870	7.56208e5	3.06727e4	9.8173
6	3.114	VV	0.5126	1.09211e6	2.61814e4	14.1780
7	4.127	VV	0.0995	7.59660e4	1.07728e4	0.9862
8	4.504	VV	0.4898	2.66799e5	6970.31738	3.4636
9	4.962	VBA	0.3562	1.77170e4	828.87286	0.2300
Totals :				7.70282e6	4.05873e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\045-2201.D
Sample Name: HD-2.0-03

Acq. Operator : Lee Siew Ling Seq. Line : 22
Acq. Instrument : Instrument 1 Location : Vial 45
Injection Date : 12/18/2012 12:51:29 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.142	BV	0.2283	6726.72705	492.95624	1.5613
2	0.637	VV	0.4474	6.31798e4	1959.75000	14.6639
3	1.384	VV	0.1607	4679.38818	473.44095	1.0861
4	2.050	VV	0.2549	1.10250e5	5564.38623	25.5888
5	2.641	VV	0.3233	1.22220e5	4937.64990	28.3670
6	3.569	VV	0.2975	3.90144e4	1675.87817	9.0552
7	3.868	VV	0.2041	2.05395e4	1432.04529	4.7672
8	4.175	VV	0.3076	3.58567e4	1508.50806	8.3223
9	4.491	VV	0.1302	6370.92578	728.19312	1.4787
10	4.802	VBA	0.2387	2.20147e4	1313.84460	5.1096

Instrument 1 12/18/2012 1:50:01 PM Lee Siew Ling Page 1 of 2

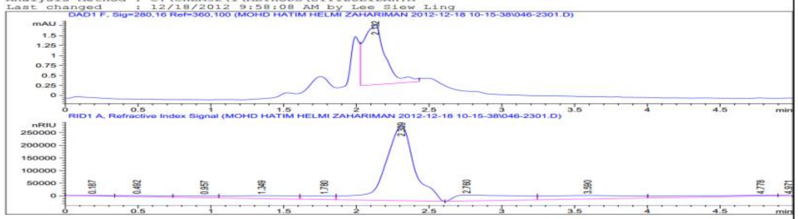
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\045-2201.D
Sample Name: HD-2.0-03

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
Totals :				4.30852e5	2.00867e4	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\046-2301.D
Sample Name: HD-2.0-04

Acq. Operator : Lee Siew Ling Seq. Line : 23
Acq. Instrument : Instrument 1 Location : Vial 46
Injection Date : 12/18/2012 12:58:45 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.187	BV	0.2352	3.13171e4	1881.99927	0.4795
2	0.492	VV	0.3514	1.01056e5	4144.89697	1.5472

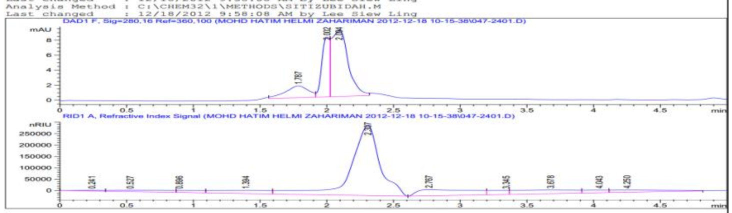
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\046-2301.D
Sample Name: HD-2.0-04

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.957	VV	0.2352	1.33174e5	7828.96582	2.0389
4	1.349	VV	0.4415	3.68442e5	1.14760e4	5.6409
5	1.780	VV	0.2054	2.15182e5	1.48819e4	3.2945
6	2.309	VV	0.2043	4.13085e6	2.95109e5	63.2445
7	2.760	VV	0.3954	7.02939e5	2.41747e4	10.7622
8	3.590	VV	0.5555	5.76479e5	1.37055e4	8.8261
9	4.778	VV	1.2006	2.66519e5	2742.95850	4.0805
10	4.971	VBA	0.1285	5600.36914	726.65045	0.0857
Totals :				6.53156e6	3.76672e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\047-2401.D
Sample Name: HD-2.0-05

Acq. Operator : Lee Siew Ling Seq. Line : 24
Acq. Instrument : Instrument 1 Location : Vial 47
Injection Date : 12/18/2012 1:06:05 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\047-2401.D
Sample Name: HD-2.0-05

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.241	BV	0.2113	4.59399e4	3316.32275	0.6250
2	0.527	VV	0.4498	2.16281e5	6340.38379	2.9426
3	0.896	VV	0.1903	1.31191e5	9192.09570	1.7849
4	1.394	VV	0.3891	4.00131e5	1.40218e4	5.4439
5	2.307	VV	0.2174	4.64288e6	3.07181e5	63.1675
6	2.767	VV	0.3835	7.61697e5	2.71504e4	10.3631
7	3.345	VV	0.1553	1.92090e5	1.82404e4	2.6134
8	3.678	VV	0.4311	5.20076e5	1.61825e4	7.0758
9	4.043	VV	0.1776	1.50157e5	1.20632e4	2.0429
10	4.250	VV	0.4258	2.89664e5	1.00198e4	3.9409
Totals :				7.35010e6	4.23708e5	

*** End of Report ***

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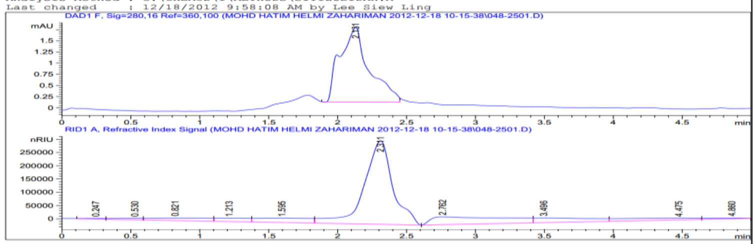
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\048-2501.D
Sample Name: HD-2.0-06

    =====================================================================
    Acq. Operator     : Lee Siew Ling                        Seq. Line :  25
    Acq. Instrument   : Instrument 1                          Location : Vial 48
    Injection Date    : 12/18/2012 1:13:27 PM                      Inj :   1
                                                            Inj Volume : 10 µl
    Acq. Method       : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
    Last changed      : 12/18/2012 9:58:08 AM by Lee Siew Ling
    Analysis Method   : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
    Last changed      : 12/18/2012 9:58:08 AM by Lee Siew Ling
```

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    =====================================================================
                         Area Percent Report
    =====================================================================
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Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.247	BV	0.1427	2.44701e4	2399.86133	0.3289
2	0.530	VV	0.1896	7.45351e4	5532.00879	1.0017

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.821	VV	0.4187	2.77152e5	9137.32129	3.7249
4	1.213	VV	0.2370	2.07482e5	1.24924e4	2.7885
5	1.595	VV	0.3785	4.34047e5	1.60325e4	5.8335
6	2.311	VV	0.2059	4.51732e6	3.15528e5	60.7122
7	2.762	VV	0.4848	1.07856e6	2.96551e4	14.4958
8	3.496	VV	0.3803	4.66640e5	1.74974e4	6.2716
9	4.475	VV	0.6022	3.02573e5	6338.95166	4.0665
10	4.860	VBA	0.3133	5.77579e4	2577.29102	0.7763
Totals :				7.44054e6	4.17191e5	

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                      *** End of Report ***
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Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\001-0101.D
Sample Name: SG-0.5-01

    =====================================================================
    Acq. Operator     : Lee Siew Ling                        Seq. Line :   1
    Acq. Instrument   : Instrument 1                          Location : Vial 1
    Injection Date    : 12/14/2012 6:10:59 PM                      Inj :   1
                                                            Inj Volume : 10 µl
    Sequence File     : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM
                        HELMI ZAHARIMAN.S
    Method            : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
    Last changed      : 12/14/2012 6:09:03 PM by Lee Siew Ling
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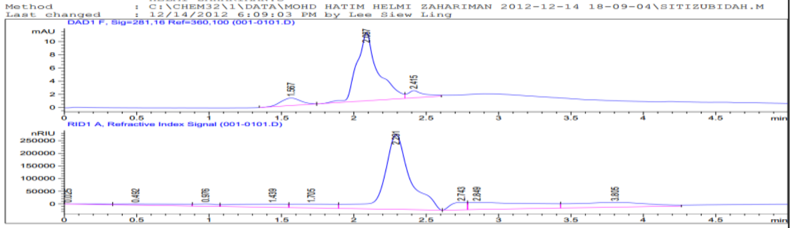


```
    =====================================================================
                         Area Percent Report
    =====================================================================

    Sorted By             :      Signal
    Multiplier:                  :          1.0000
    Dilution:                    :          1.0000
    Use Multiplier & Dilution Factor with ISTDs
```


Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.025	BV	1.8797	2.73099e4	242.15280	0.4307
2	0.492	VV	0.4988	1.70385e5	4404.82373	2.6874
3	0.976	VV	0.1398	9.30170e4	9179.46875	1.4671
4	1.439	VV	0.3681	3.09583e5	1.24386e4	4.8829
5	1.705	VV	0.2909	3.08566e5	1.50607e4	4.8668
6	2.291	VV	0.1755	3.64079e6	2.96799e5	57.4239
7	2.743	VV	0.1225	2.20622e5	2.92546e4	3.4797
8	2.849	VV	0.3903	8.71206e5	2.83983e4	13.7410
9	3.805	VV	0.5285	6.98721e5	1.89019e4	11.0205
Totals :				6.34020e6	4.14679e5	

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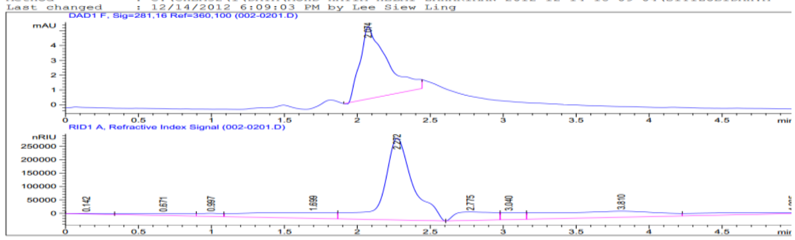
=====================================================================
                      *** End of Report ***
```

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\002-0201.D
Sample Name: SG-0.5-02

Acq. Operator : Lee Siew Ling Seq. Line : 2
Acq. Instrument : Instrument 1 Location : Vial 2
Injection Date : 12/14/2012 6:18:18 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

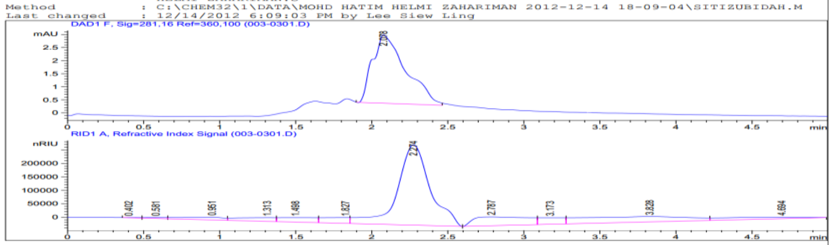
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.142	BV	0.2951	3.62213e4	1768.35132	0.4574
2	0.671	VV	0.4359	2.28619e5	7824.32520	2.8870

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.997	VV	0.1436	1.25385e5	1.19902e4	1.5834
4	1.699	VV	0.5015	8.62296e5	2.21617e4	10.8892
5	2.272	VV	0.1965	4.19621e6	3.06376e5	52.9904
6	2.775	VV	0.2752	5.91006e5	3.14764e4	7.4633
7	3.040	VV	0.1500	2.81718e5	2.64914e4	3.5576
8	3.810	VV	0.7549	1.27561e6	2.25549e4	16.1086
9	4.985	VBA	1.4624	3.21746e5	3666.92285	4.0631
Totals :				7.91881e6	4.34310e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\003-0301.D
Sample Name: SG-0.5-03

Acq. Operator : Lee Siew Ling Seq. Line : 3
Acq. Instrument : Instrument 1 Location : Vial 3
Injection Date : 12/14/2012 6:25:38 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

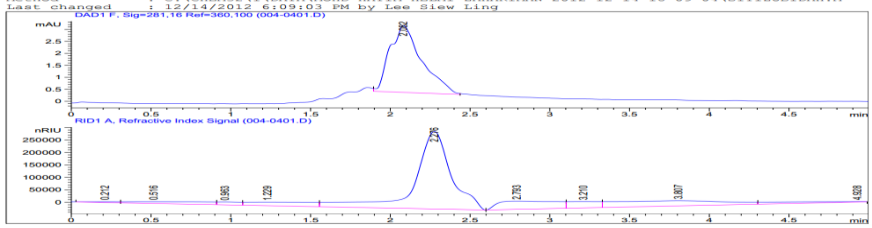
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.402	BV	0.1575	7281.31299	625.24091	0.0939
2	0.581	VV	0.1375	3.18005e4	3261.06787	0.4102

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.951	VV	0.2273	1.73989e5	9973.61426	2.2445
4	1.313	VV	0.2721	2.25496e5	1.35394e4	2.9089
5	1.498	VV	0.2434	2.74512e5	1.63530e4	3.5413
6	1.827	VV	0.1642	2.48399e5	2.12868e4	3.2044
7	2.274	VV	0.2231	4.44420e6	2.99055e5	57.3311
8	2.787	VV	0.3530	7.92801e5	3.25819e4	10.2273
9	3.173	VV	0.1633	2.71373e5	2.41914e4	3.5008
10	3.828	VV	0.6907	1.01796e6	1.96536e4	13.1318
11	4.694	VBA	0.7296	2.64011e5	5285.35986	3.4058
Totals :				7.75182e6	4.45806e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\004-0401.D
Sample Name: SG-0.5-04

Acq. Operator	: Lee Siew Ling	Seq. Line :	4
Acq. Instrument	: Instrument 1	Location :	Vial 4
Injection Date	: 12/14/2012 6:32:59 PM	Inj :	1
		Inj Volume :	10 µl
Sequence File	: C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S		
Method	: C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M		
Last changed	: 12/14/2012 6:09:03 PM by Lee Siew Ling		



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

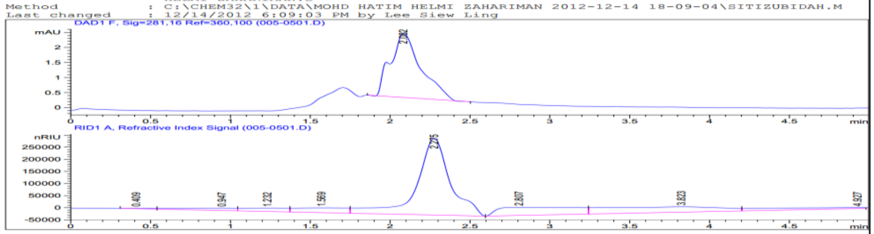
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.212	BV	0.1779	3.66598e4	2814.99072	0.4517
2	0.516	VV	0.5456	2.80014e5	6825.28516	3.4502

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.963	VV	0.1338	1.12818e5	1.17261e4	1.3901
4	1.229	VV	0.4198	4.28690e5	1.40017e4	5.2821
5	2.276	VV	0.2305	4.89275e6	3.11886e5	60.2856
6	2.793	VV	0.3560	8.23123e5	3.27301e4	10.1420
7	3.210	VV	0.1922	3.40996e5	2.52302e4	4.2016
8	3.807	VV	0.6856	1.02166e6	2.04843e4	12.5883
9	4.928	VBA	2.1545	1.79239e5	1386.56213	2.2085
Totals :				8.11595e6	4.27085e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\005-0501.D
Sample Name: SG-0.5-05

Acq. Operator	: Lee Siew Ling	Seq. Line :	5
Acq. Instrument	: Instrument 1	Location :	Vial 5
Injection Date	: 12/14/2012 6:40:19 PM	Inj :	1
		Inj Volume :	10 µl
Sequence File	: C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S		
Method	: C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M		
Last changed	: 12/14/2012 6:09:03 PM by Lee Siew Ling		



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 F, Sig=281,16 Ref=360,100

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.082	BB	0.1833	28.08527	2.13763	100.0000
Totals :				28.08527	2.13763	

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.409	BV	0.2129	2.30883e4	1529.13599	0.2837
2	0.947	VV	0.2757	2.17428e5	1.00669e4	2.6717

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.232	VV	0.2832	2.63414e5	1.40718e4	3.2367
4	1.569	VV	0.3099	4.29606e5	1.94236e4	5.2788
5	2.275	VV	0.2080	4.60522e6	3.17727e5	56.5869
6	2.807	VV	0.4451	1.08982e6	3.36272e4	13.3912
7	3.823	VV	0.7228	1.18861e6	2.18637e4	14.6051
8	4.927	VV	1.1018	3.21129e5	3561.00635	3.9459
Totals :				8.13832e6	4.21870e5	

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\006-0601.D
Sample Name: SG-0.5-06

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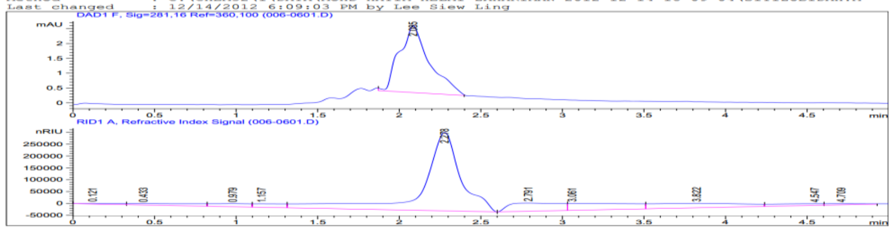
Acq. Operator : Lee Siew Ling   Seq. Line : 6
Acq. Instrument : Instrument 1   Location : Vial 6
Injection Date : 12/14/2012 6:47:39 PM   Inj : 1
                    Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



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Area Percent Report
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Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.121	BV	0.4105	4.31212e4	1750.79077	0.5152
2	0.433	VV	0.4987	2.11009e5	5483.11133	2.5212
3	0.979	VV	0.2109	2.01164e5	1.26861e4	2.4036
4	1.157	VV	0.1897	1.92031e5	1.44445e4	2.2945
5	2.278	VV	0.2256	5.29350e6	3.30789e5	63.2487
6	2.791	VV	0.3203	7.47481e5	3.44206e4	8.9312
7	3.061	VV	0.3186	7.16237e5	2.83435e4	8.5579
8	3.822	VV	0.5063	7.25050e5	1.91586e4	8.6632
9	4.547	VV	0.3781	1.71770e5	6623.68506	2.0524
10	4.709	VV	0.2384	6.79806e4	4458.11523	0.8123

Totals : 8.36934e6 4.58158e5

Instrument 1 12/14/2012 6:53:08 PM Lee Siew Ling   Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\006-0601.D
Sample Name: SG-0.5-06

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*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\007-0701.D
Sample Name: SG-1.0-01

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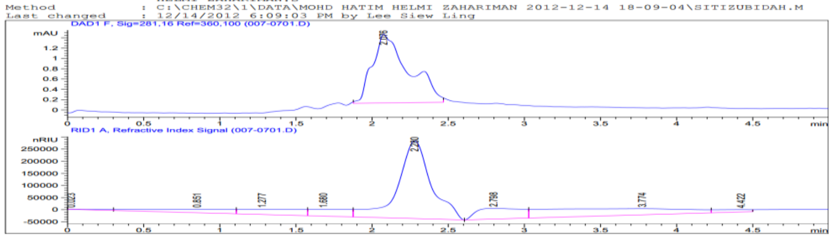
Acq. Operator : Lee Siew Ling   Seq. Line : 7
Acq. Instrument : Instrument 1   Location : Vial 7
Injection Date : 12/14/2012 6:55:03 PM   Inj : 1
                    Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



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Area Percent Report
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Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.023	BV	1.5584	3.75662e4	401.76389	0.3925
2	0.851	VV	0.5096	5.70052e5	1.49524e4	5.9567
3	1.277	VV	0.3774	6.31007e5	2.16098e4	6.5936
4	1.680	VV	0.2701	5.14371e5	2.80456e4	5.3748
5	2.280	VV	0.2193	4.85428e6	3.21617e5	50.7240
6	2.798	VV	0.3037	9.06744e5	4.38862e4	9.4749
7	3.774	VV	0.9627	1.88769e6	2.49474e4	19.7251
8	4.422	VV	0.2606	1.68285e5	9404.69922	1.7585

Totals : 9.57000e6 4.64865e5

Instrument 1 12/14/2012 7:00:29 PM Lee Siew Ling   Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\007-0701.D
Sample Name: SG-1.0-01

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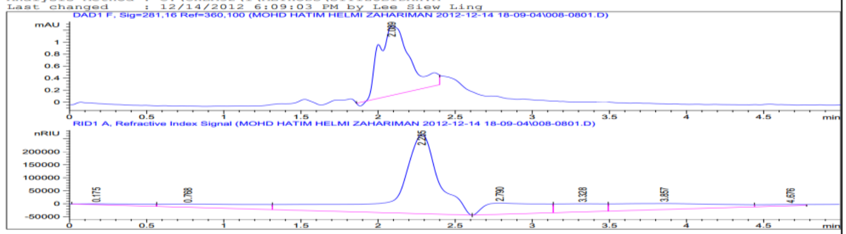
*** End of Report ***

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\008-0801.D
Sample Name: SG-1.0-02

    =====================================================================
    Acq. Operator   : Lee Siew Ling                     Seq. Line :   8
    Acq. Instrument : Instrument 1                       Location : Vial 8
    Injection Date  : 12/14/2012 7:02:21 PM                   Inj :   1
                                                       Inj Volume : 10 µl
    Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
    Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
    Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
    Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
```

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    =====================================================================
                         Area Percent Report
    =====================================================================

    Sorted By             :      Signal
    Multiplier:                  :      1.0000
    Dilution:                    :      1.0000
    Use Multiplier & Dilution Factor with ISTDs
```

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.175	BV	0.6054	1.53965e5	3245.02051	1.6669
2	0.768	VV	0.6733	6.38296e5	1.21938e4	6.9105

Instrument 1 12/14/2012 7:16:19 PM Lee Siew Ling   Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\008-0801.D
Sample Name: SG-1.0-02

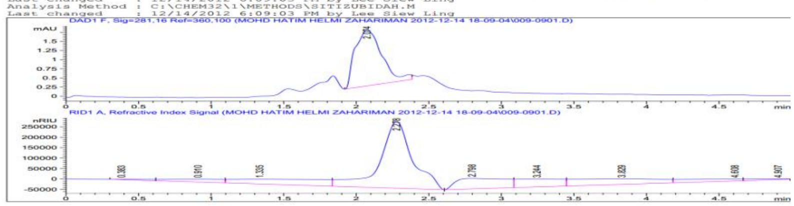
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	2.285	VV	0.2601	5.48987e6	3.04449e5	59.4360
4	2.790	VV	0.3561	1.09392e6	4.28526e4	11.8433
5	3.328	VV	0.3009	6.59068e5	3.08785e4	7.1354
6	3.857	VV	0.6163	1.08655e6	2.27203e4	11.7635
7	4.676	VV	0.3109	1.14939e5	4930.35156	1.2444

Totals : 9.23661e6 4.21270e5

*** End of Report ***

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\009-0901.D
Sample Name: SG-1.0-03

    =====================================================================
    Acq. Operator   : Lee Siew Ling                     Seq. Line :   9
    Acq. Instrument : Instrument 1                       Location : Vial 9
    Injection Date  : 12/14/2012 7:09:42 PM                   Inj :   1
                                                       Inj Volume : 10 µl
    Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
    Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
    Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
    Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
```




```
    =====================================================================
                         Area Percent Report
    =====================================================================

    Sorted By             :      Signal
    Multiplier:                  :      1.0000
    Dilution:                    :      1.0000
    Use Multiplier & Dilution Factor with ISTDs
```

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.383	BV	0.4304	6.43022e4	1895.34302	0.6383
2	0.910	VV	0.3420	3.48372e5	1.36041e4	3.4580

Instrument 1 12/14/2012 7:17:03 PM Lee Siew Ling   Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\009-0901.D
Sample Name: SG-1.0-03

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.335	VV	0.6463	1.10559e6	2.28597e4	10.9742
4	2.278	VV	0.2233	4.99687e6	3.19910e5	49.5994
5	2.798	VV	0.3349	1.17764e6	5.04652e4	11.6894
6	3.244	VV	0.3205	8.06170e5	3.77459e4	8.0021
7	3.829	VV	0.5865	1.12812e6	2.63184e4	11.1979
8	4.608	VV	0.5602	3.57633e5	8969.66309	3.5499
9	4.907	VBA	0.4725	8.97487e4	3165.96924	0.8909

Totals : 1.00745e7 4.84934e5

*** End of Report ***

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\010-1001.D
Sample Name: SG-1.0-04

=====================================================================
Acq. Operator   : Lee Siew Ling                    Seq. Line :  10
Acq. Instrument : Instrument 1                      Location : Vial 10
Injection Date  : 12/14/2012 7:17:04 PM                  Inj :  1
                                                 Inj Volume : 10 µl
Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
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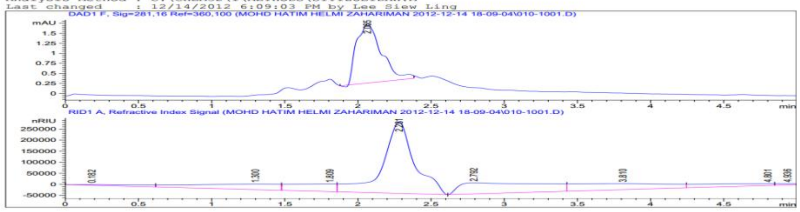


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=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier:                  :      1.0000
Dilution:                    :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.182	BV	0.6696	1.81149e5	3519.45898	1.7386
2	1.300	VV	0.5069	9.72506e5	2.48150e4	9.3338

Instrument 1 12/14/2012 9:04:46 PM Lee Siew Ling Page 1 of 2

```
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\010-1001.D
Sample Name: SG-1.0-04
```

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.809	VV	0.2807	7.10413e5	3.42672e4	6.8183
4	2.281	VV	0.2180	4.91501e6	3.23949e5	47.1728
5	2.792	VV	0.5034	1.91434e6	5.01747e4	18.3733
6	3.810	VV	0.6034	1.24706e6	2.72305e4	11.9689
7	4.801	VV	0.6530	4.27452e5	8007.48047	4.1026
8	4.936	VBA	0.1348	5.12205e4	5490.02832	0.4916
Totals :				1.04191e7	4.77453e5	

```
=====================================================================
                        *** End of Report ***
```

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Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\011-1101.D
Sample Name: SG-1.0-05

=====================================================================
Acq. Operator   : Lee Siew Ling                    Seq. Line :  11
Acq. Instrument : Instrument 1                      Location : Vial 11
Injection Date  : 12/14/2012 7:24:26 PM                  Inj :  1
                                                 Inj Volume : 10 µl
Acq. Method     : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed    : 12/14/2012 6:09:03 PM by Lee Siew Ling
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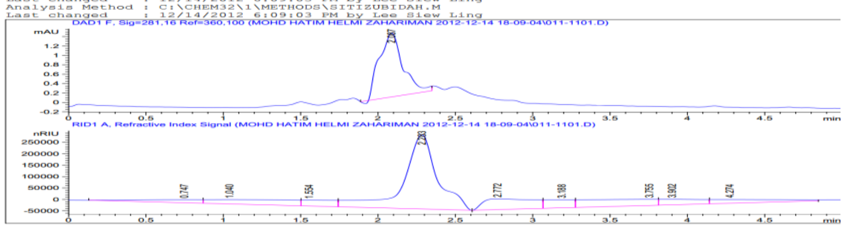


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=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier:                  :      1.0000
Dilution:                    :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.747	BV	0.3894	3.57155e5	1.36539e4	3.6195
2	1.040	VV	0.5735	7.91085e5	1.91174e4	8.0170

Instrument 1 12/14/2012 9:05:16 PM Lee Siew Ling Page 1 of 2

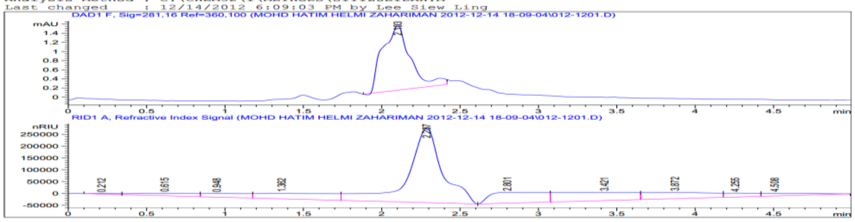
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\011-1101.D
Sample Name: SG-1.0-05

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.554	VV	0.2065	3.87028e5	2.59353e4	3.9222
4	2.283	VV	0.2164	4.94597e6	3.24983e5	50.1236
5	2.772	VV	0.3149	1.04342e6	4.70429e4	10.5742
6	3.188	VV	0.1824	4.45923e5	3.51826e4	4.5191
7	3.755	VV	0.4514	9.61330e5	2.69091e4	9.7423
8	3.902	VV	0.2545	4.43005e5	2.42168e4	4.4895
9	4.274	VV	0.4167	4.92629e5	1.64311e4	4.9924
Totals :				9.86755e6	5.33473e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\012-1201.D
Sample Name: SG-1.0-06

Acq. Operator : Lee Siew Ling Seq. Line : 12
Acq. Instrument : Instrument 1 Location : Vial 12
Injection Date : 12/14/2012 7:31:44 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.212	BV	0.1980	3.09820e4	2182.30200	0.3193
2	0.615	VV	0.3903	2.66656e5	9816.69531	2.7484

Instrument 1 12/14/2012 9:06:00 PM Lee Siew Ling Page 1 of 2

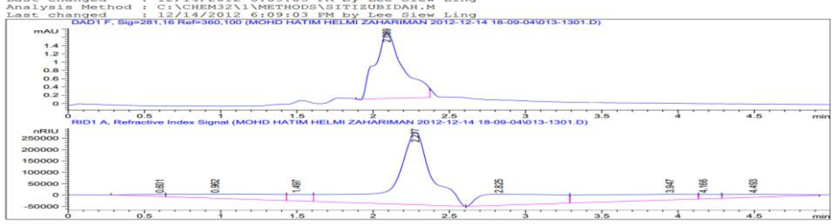
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\012-1201.D
Sample Name: SG-1.0-06

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.948	VV	0.2831	3.18510e5	1.50833e4	3.2828
4	1.362	VV	0.4596	7.99401e5	2.25164e4	8.2392
5	2.287	VV	0.2146	4.84149e6	3.17465e5	49.9000
6	2.801	VV	0.3348	1.05263e6	4.51266e4	10.8492
7	3.421	VV	0.4951	1.18150e6	3.33782e4	12.1775
8	3.872	VV	0.4223	7.59901e5	2.57328e4	7.8321
9	4.255	VV	0.1945	2.22067e5	1.64166e4	2.2888
10	4.508	VBA	0.3299	2.29235e5	1.13851e4	2.3627
Totals :				9.70237e6	4.99103e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\013-1301.D
Sample Name: SG-1.5-01

Acq. Operator : Lee Siew Ling Seq. Line : 13
Acq. Instrument : Instrument 1 Location : Vial 13
Injection Date : 12/14/2012 7:39:03 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.601	BV	0.2078	1.17490e5	9443.78223	1.1397
2	0.962	VV	0.6186	9.10299e5	1.81851e4	8.8302

Instrument 1 12/14/2012 9:11:52 PM Lee Siew Ling Page 1 of 2

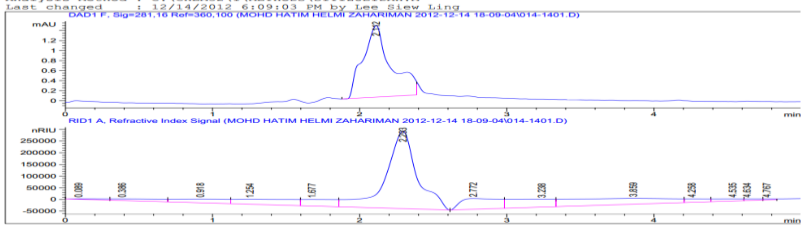
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\013-1301.D
Sample Name: SG-1.5-01

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.497	VV	0.1518	3.02615e5	2.80374e4	2.9355
4	2.277	VV	0.2317	5.33558e6	3.19220e5	51.7567
5	2.825	VV	0.4617	1.65359e6	4.88738e4	16.0403
6	3.947	VV	0.7305	1.43900e6	2.48159e4	13.9588
7	4.166	VV	0.1271	1.69725e5	1.95669e4	1.6464
8	4.493	VV	0.4141	3.80667e5	1.32035e4	3.6926
Totals :				1.03090e7	4.81347e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\014-1401.D
Sample Name: SG-1.5-02

Acq. Operator : Lee Siew Ling Seq. Line : 14
Acq. Instrument : Instrument 1 Location : Vial 14
Injection Date : 12/14/2012 7:46:21 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.089	BV	0.4601	5.25692e4	1904.14429	0.5335
2	0.386	VV	0.3869	1.97777e5	7022.17725	2.0072

Instrument 1 12/14/2012 9:12:29 PM Lee Siew Ling Page 1 of 2

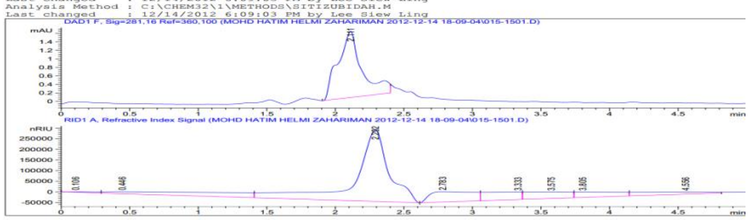
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\014-1401.D
Sample Name: SG-1.5-02

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.918	VV	0.3465	3.86200e5	1.56376e4	3.9194
4	1.254	VV	0.4031	6.44542e5	2.11467e4	6.5412
5	1.677	VV	0.2326	4.50135e5	2.80451e4	4.5683
6	2.293	VV	0.2117	4.90797e6	3.31264e5	49.8093
7	2.772	VV	0.2575	8.17117e5	4.58771e4	8.2926
8	3.238	VV	0.2956	7.36040e5	3.37284e4	7.4698
9	3.859	VV	0.7078	1.30214e6	2.46182e4	13.2149
10	4.258	VV	0.1478	1.51780e5	1.47966e4	1.5404
11	4.535	VV	0.1983	1.33981e5	9302.41797	1.3597
12	4.634	VV	0.0987	4.95901e4	7303.90186	0.5033
13	4.767	VV	0.0755	2.36898e4	4576.83984	0.2404
Totals :				9.85353e6	5.45224e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\015-1501.D
Sample Name: SG-1.5-03

Acq. Operator : Lee Siew Ling Seq. Line : 15
Acq. Instrument : Instrument 1 Location : Vial 15
Injection Date : 12/14/2012 7:53:41 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.106	BV	0.2950	4.93454e4	2210.45532	0.4848
2	0.446	VV	1.3684	9.93331e5	8919.52930	9.7589

Instrument 1 12/14/2012 9:13:05 PM Lee Siew Ling Page 1 of 2

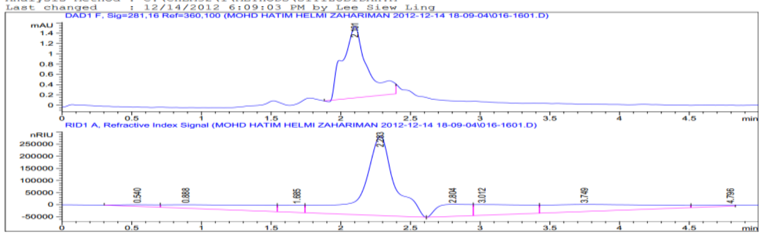
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\015-1501.D
Sample Name: SG-1.5-03

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	2.292	VV	0.2382	5.76251e6	3.37251e5	56.6130
4	2.783	VV	0.3057	1.04785e6	4.81502e4	10.2945
5	3.333	VV	0.2879	6.83498e5	3.50644e4	6.7149
6	3.575	VV	0.3106	6.91840e5	3.04356e4	6.7969
7	3.805	VV	0.2926	5.26751e5	2.50780e4	5.1750
8	4.556	VV	0.5616	4.23638e5	9377.56055	4.1620
Totals :				1.01788e7	4.96486e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\016-1601.D
Sample Name: SG-1.5-04

Acq. Operator : Lee Siew Ling Seq. Line : 16
Acq. Instrument : Instrument 1 Location : Vial 16
Injection Date : 12/14/2012 8:01:01 PM Inj : 1
Inj Volume : 10 µl
Acq. Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling
Analysis Method : C:\CHEM32\1\METHODS\SITIZUBIDAH.M
Last changed : 12/14/2012 6:09:03 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.540	BV	0.2741	1.31343e5	6828.17383	1.3104
2	0.888	VV	0.8315	9.31060e5	1.43692e4	9.2888

Instrument 1 12/14/2012 9:13:36 PM Lee Siew Ling Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 18-09-04\016-1601.D
Sample Name: SG-1.5-04

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.685	VV	0.1628	3.40654e5	2.94966e4	3.3986
4	2.283	VV	0.2169	5.07768e6	3.28871e5	50.6580
5	2.804	VV	0.2516	8.15313e5	4.92059e4	8.1340
6	3.012	VV	0.3561	1.12851e6	4.42194e4	11.2587
7	3.749	VV	0.7075	1.47573e6	2.88211e4	14.7228
8	4.796	VV	0.3986	1.23169e5	4305.00488	1.2288
Totals :				1.00235e7	5.06116e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\017-0101.D
Sample Name: SG-1.5-05

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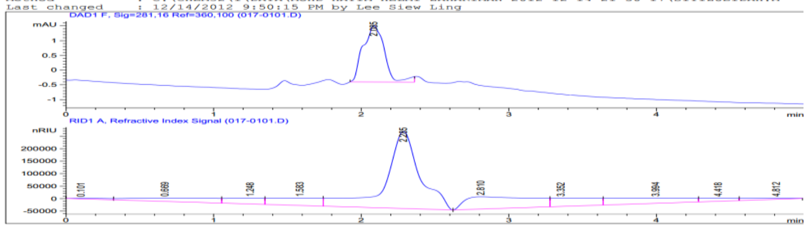
Acq. Operator : Lee Siew Ling   Seq. Line : 1
Acq. Instrument : Instrument 1   Location : Vial 17
Injection Date : 12/14/2012 9:52:06 PM   Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



===
Area Percent Report
===

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.101	BV	0.4401	5.67037e4	2147.41626	0.5701
2	0.669	VV	0.5697	5.64036e5	1.33184e4	5.6710

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\017-0101.D
Sample Name: SG-1.5-05

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	1.248	VV	0.2297	3.78819e5	2.26453e4	3.8088
4	1.583	VV	0.3351	6.74867e5	2.95999e4	6.7853
5	2.285	VV	0.2288	4.96968e6	3.08779e5	49.9665
6	2.810	VV	0.4247	1.52361e6	4.90985e4	15.3188
7	3.352	VV	0.3101	6.55334e5	3.26009e4	6.5889
8	3.994	VV	0.5445	8.05198e5	2.07035e4	8.0957
9	4.418	VV	0.2284	1.90574e5	1.17319e4	1.9161
10	4.812	VBA	0.3914	1.27202e5	4426.35937	1.2789
Totals :				9.94602e6	4.95051e5	

===
*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\018-0201.D
Sample Name: SG-1.5-06

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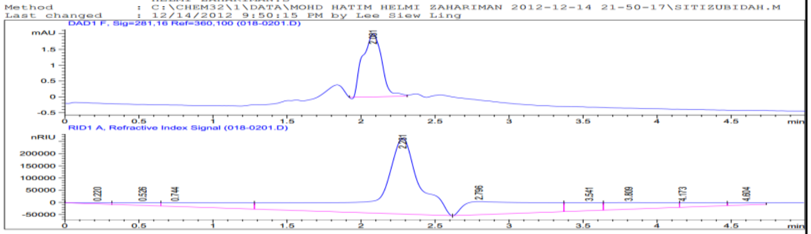
Acq. Operator : Lee Siew Ling   Seq. Line : 2
Acq. Instrument : Instrument 1   Location : Vial 18
Injection Date : 12/14/2012 9:59:26 PM   Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



===
Area Percent Report
===

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.220	BV	0.1824	6.27424e4	4677.17432	0.5904
2	0.526	VV	0.2697	2.01482e5	1.12357e4	1.8958

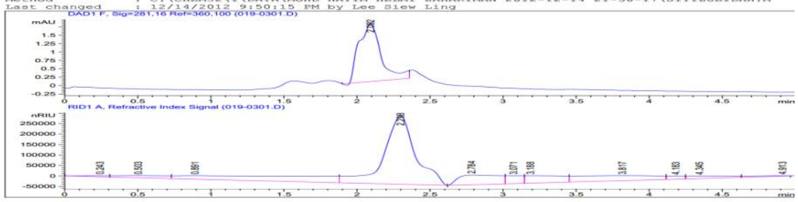
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.744	VV	0.5972	7.40268e5	1.55299e4	6.9654
4	2.281	VV	0.2638	5.95936e6	3.12053e5	56.0737
5	2.796	VV	0.4734	1.92306e6	5.40512e4	18.0947
6	3.541	VV	0.2300	5.43397e5	3.31756e4	5.1130
7	3.809	VV	0.4006	7.76818e5	2.75165e4	7.3093
8	4.173	VV	0.2443	2.89784e5	1.83966e4	2.7267
9	4.604	VV	0.2134	1.30819e5	8433.75586	1.2309

Totals : 1.06277e7 4.85070e5

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\019-0301.D
Sample Name: SG-2.0-01

Acq. Operator : Lee Siew Ling Seq. Line : 3
Acq. Instrument : Instrument 1 Location : Vial 19
Injection Date : 12/14/2012 10:06:45 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.243	BV	0.1590	5.55442e4	4714.99072	0.5623
2	0.503	VV	0.3640	2.42716e5	9602.15137	2.4571

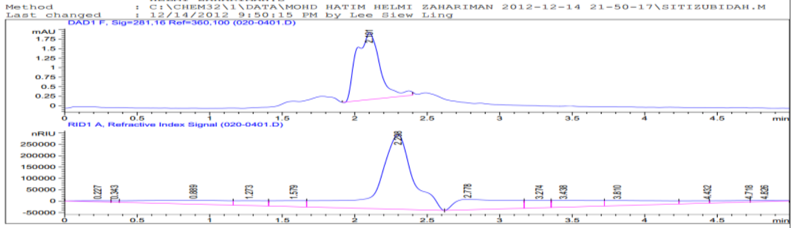
Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.891	VV	1.1464	1.52451e6	1.61856e4	15.4333
4	2.298	VV	0.2281	4.91456e6	3.25280e5	49.7522
5	2.784	VV	0.2745	8.83721e5	4.62984e4	8.9463
6	3.071	VV	0.1106	2.92536e5	3.74481e4	2.9615
7	3.188	VV	0.2572	5.99383e5	3.51650e4	6.0678
8	3.817	VV	0.5273	9.32225e5	2.34046e4	9.4373
9	4.183	VV	0.1147	1.21461e5	1.52183e4	1.2296
10	4.345	VV	0.2531	2.34641e5	1.21678e4	2.3754
11	4.913	VV	0.4759	7.67816e4	2123.40063	0.7773

Totals : 9.87808e6 5.27609e5

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\020-0401.D
Sample Name: SG-2.0-02

Acq. Operator : Lee Siew Ling Seq. Line : 4
Acq. Instrument : Instrument 1 Location : Vial 20
Injection Date : 12/14/2012 10:14:08 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.227	BV	0.2260	6.02115e4	4440.04199	0.6093
2	0.343	VV	0.0515	2.13424e4	6117.35449	0.2160

Instrument 1 12/14/2012 10:19:36 PM Lee Siew Ling Page 1 of 2

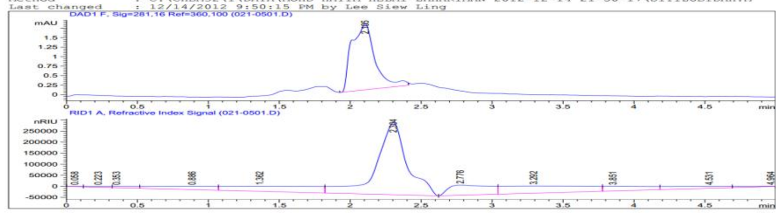
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\020-0401.D
Sample Name: SG-2.0-02

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.889	VV	0.5166	6.52471e5	1.66879e4	6.6022
4	1.273	VV	0.2081	3.12267e5	2.12548e4	3.1598
5	1.579	VV	0.2170	4.02479e5	2.63578e4	4.0726
6	2.298	VV	0.2417	5.34065e6	3.28118e5	54.0411
7	2.778	VV	0.3568	1.19965e6	4.58937e4	12.1391
8	3.274	VV	0.1571	3.61022e5	3.21015e4	3.6531
9	3.438	VV	0.2746	6.00946e5	2.92108e4	6.0809
10	3.810	VV	0.3451	5.82319e5	2.23466e4	5.8924
11	4.432	VV	0.1957	1.51113e5	1.05166e4	1.5291
12	4.718	VV	0.2913	1.37852e5	6265.05078	1.3949
13	4.826	VBA	0.1934	6.02408e4	4424.70752	0.6096
Totals :				9.88256e6	5.53735e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\021-0501.D
Sample Name: SG-2.0-03

Acq. Operator : Lee Siew Ling Seq. Line : 5
Acq. Instrument : Instrument 1 Location : Vial 21
Injection Date : 12/14/2012 10:21:29 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.058	BV	0.1195	7325.77148	1021.90729	0.0764
2	0.223	VV	0.1599	4.41169e4	3720.94287	0.4604

Instrument 1 12/14/2012 10:26:56 PM Lee Siew Ling Page 1 of 2

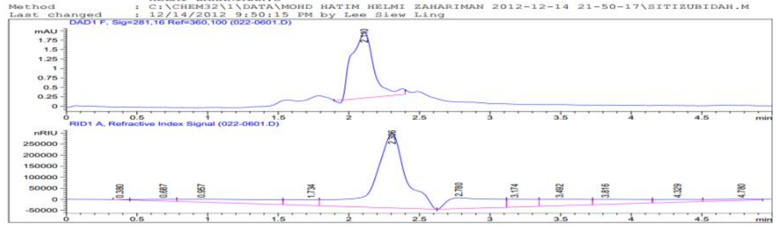
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\021-0501.D
Sample Name: SG-2.0-03

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.353	VV	0.1917	7.68487e4	5626.96533	0.8020
4	0.886	VV	0.3694	4.33067e5	1.48047e4	4.5193
5	1.362	VV	0.5863	1.06672e6	2.25566e4	11.1319
6	2.304	VV	0.2102	4.92088e6	3.26800e5	51.3526
7	2.776	VV	0.2825	9.11780e5	4.56875e4	9.5150
8	3.292	VV	0.5317	1.31075e6	3.21558e4	13.6785
9	3.851	VV	0.2904	4.49864e5	2.14172e4	4.6946
10	4.531	VV	0.4575	3.07265e5	8607.95703	3.2065
11	4.964	VBA	0.8542	5.39111e4	1051.86584	0.5626
Totals :				9.58252e6	4.83451e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\022-0601.D
Sample Name: SG-2.0-04

Acq. Operator : Lee Siew Ling Seq. Line : 6
Acq. Instrument : Instrument 1 Location : Vial 22
Injection Date : 12/14/2012 10:28:45 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.380	BV	0.1214	8270.52734	967.08618	0.0865
2	0.687	VV	0.2292	1.21707e5	7816.22314	1.2728

Instrument 1 12/14/2012 10:34:15 PM Lee Siew Ling Page 1 of 2

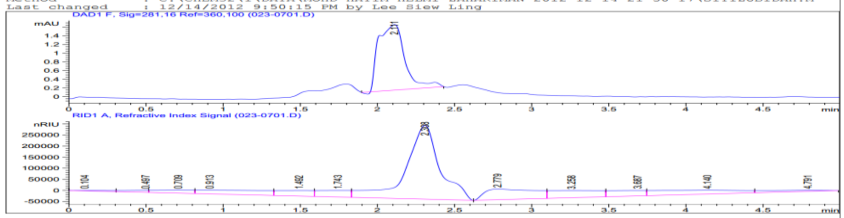
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\022-0601.D
Sample Name: SG-2.0-04

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.957	VV	0.6754	7.37898e5	1.32985e4	7.7166
4	1.734	VV	0.2066	3.89987e5	2.67785e4	4.0783
5	2.306	VV	0.2146	5.11357e6	3.35452e5	53.4755
6	2.780	VV	0.3239	1.12930e6	4.84292e4	11.8097
7	3.174	VV	0.1946	4.72382e5	3.53971e4	4.9400
8	3.492	VV	0.2932	6.43851e5	2.92905e4	6.7331
9	3.816	VV	0.3284	5.19393e5	2.29905e4	5.4316
10	4.329	VV	0.3073	2.73887e5	1.29452e4	2.8642
11	4.780	VV	0.4048	1.52205e5	5189.85303	1.5917
Totals :				9.56245e6	5.38554e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\023-0701.D
Sample Name: SG-2.0-05

Acq. Operator : Lee Siew Ling Seq. Line : 7
Acq. Instrument : Instrument 1 Location : Vial 23
Injection Date : 12/14/2012 10:36:07 PM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\SITIZUBIDAH.M
Last changed : 12/14/2012 9:50:15 PM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.104	BV	0.4134	5.08707e4	2050.95361	0.5120
2	0.497	VV	0.1492	9.36648e4	9189.36816	0.9427

Instrument 1 12/14/2012 10:41:34 PM Lee Siew Ling Page 1 of 2

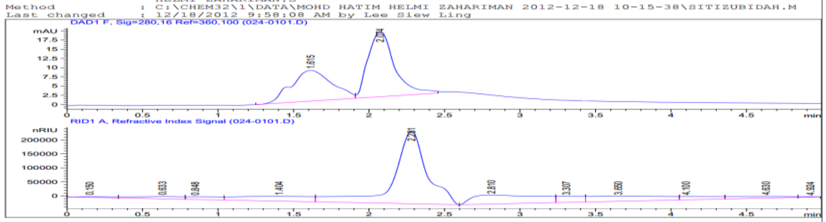
Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-14 21-50-17\023-0701.D
Sample Name: SG-2.0-05

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
3	0.709	VV	0.2341	2.23349e5	1.33449e4	2.2478
4	0.913	VV	0.4264	5.77559e5	1.67360e4	5.8126
5	1.492	VV	0.2209	3.91024e5	2.53600e4	3.9353
6	1.743	VV	0.1989	4.21859e5	2.99417e4	4.2456
7	2.308	VV	0.2120	5.06958e6	3.33342e5	51.0209
8	2.779	VV	0.3130	1.06421e6	4.75403e4	10.7104
9	3.258	VV	0.3323	7.26906e5	3.24855e4	7.3157
10	3.687	VV	0.2393	4.09633e5	2.46374e4	4.1226
11	4.140	VV	0.5658	7.30317e5	1.72301e4	7.3500
12	4.791	VBA	0.5409	1.77310e5	4595.25391	1.7845
Totals :				9.93628e6	5.56453e5	

*** End of Report ***

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\024-0101.D
Sample Name: SG-2.0-06

Acq. Operator : Lee Siew Ling Seq. Line : 1
Acq. Instrument : Instrument 1 Location : Vial 24
Injection Date : 12/18/2012 10:17:28 AM Inj : 1
Inj Volume : 10 µl
Sequence File : C:\Chem32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\MOHD HATIM HELMI ZAHARIMAN.S
Method : C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\SITIZUBIDAH.M
Last changed : 12/18/2012 9:58:08 AM by Lee Siew Ling



Area Percent Report

Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 2: RID1 A, Refractive Index Signal

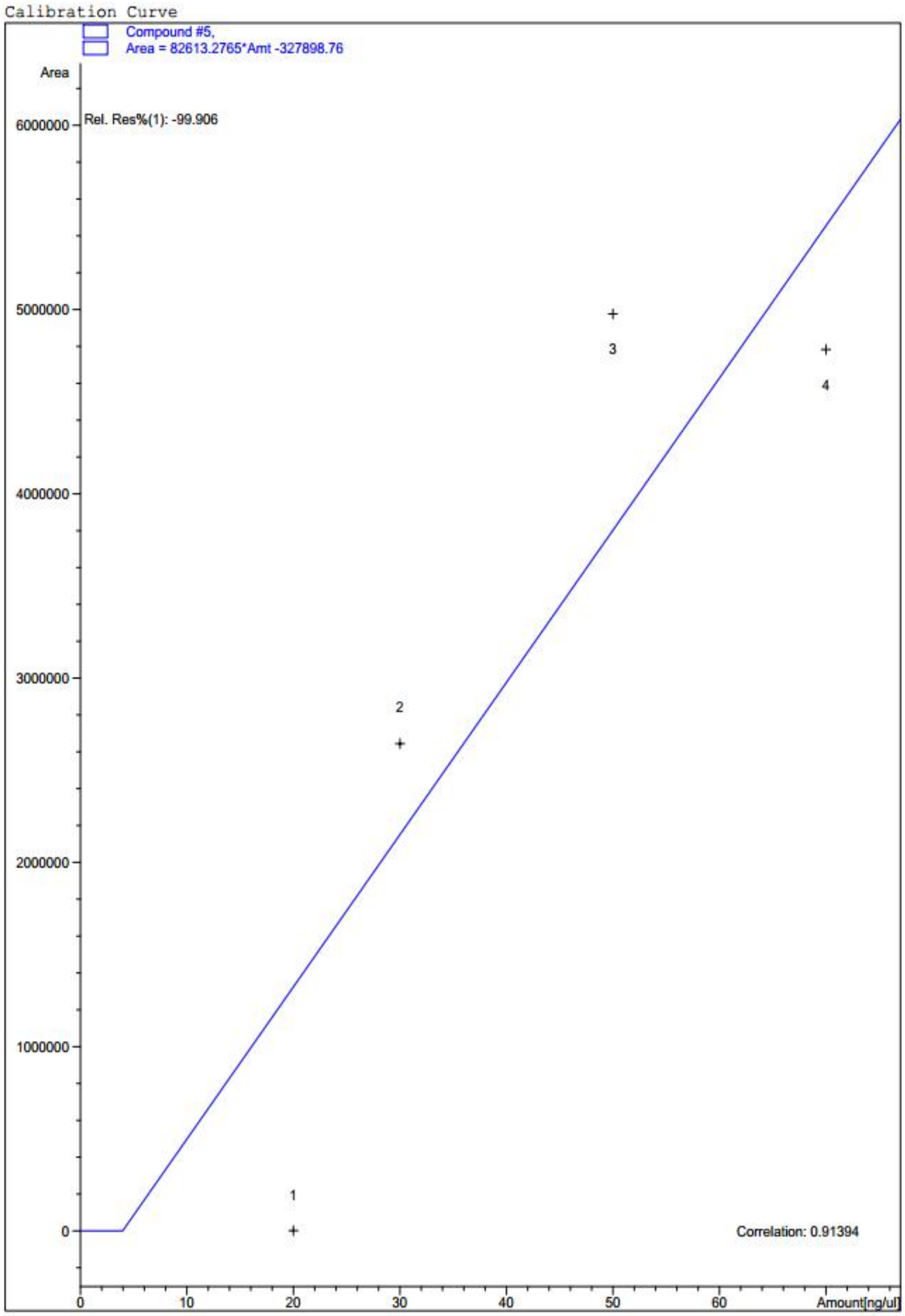
Instrument 1 12/18/2012 10:22:55 AM Lee Siew Ling Page 1 of 2

Data File C:\CHEM32\1\DATA\MOHD HATIM HELMI ZAHARIMAN 2012-12-18 10-15-38\024-0101.D
Sample Name: SG-2.0-06

Peak #	RetTime [min]	Type	Width [min]	Area [nRIU*s]	Height [nRIU]	Area %
1	0.150	BV	0.2299	4.91890e4	2784.09204	0.6879
2	0.633	VV	0.2934	1.80377e5	8412.03613	2.5227
3	0.848	VV	0.2096	1.55828e5	9781.71191	2.1794
4	1.404	VV	0.5267	5.70068e5	1.70283e4	7.9728
5	2.281	VV	0.2195	3.98014e6	2.60200e5	55.6650
6	2.810	VV	0.4308	9.69205e5	3.20287e4	13.5550
7	3.307	VV	0.1653	2.51218e5	2.16964e4	3.5135
8	3.650	VV	0.4549	6.17307e5	1.80629e4	8.6335
9	4.100	VV	0.2360	1.90936e5	1.19566e4	2.6704
10	4.630	VV	0.3912	1.69291e5	5710.58203	2.3677
11	4.924	VBA	0.1541	1.66081e4	1796.60181	0.2323
Totals :				7.15016e6	3.89458e5	

*** End of Report ***

Print of window 66: Calibration Curve



Instrument 1 12/11/2012 3:24:11 PM sitizubidah Page 1 of 1