

FORMULATION OF BITUMEN FROM INDUSTRIAL WASTE

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ABSTRACT

Bitumen is a mixture of organic liquids which is black, high viscosity and it is sticky materials where it can be applied in several of application. Waste sludge can be used as another alternative to formulate the bitumen by manipulating ratio needed. Waste sludge consists of mineral oil solid waste, which includes oily sand, tank bottoms and other three kinds of sludge from refineries such as dissolved air flotation scum, excessively activated oily sludge and bottom sludge of oil from pools. Waste sludge is the major source of pollution produced in the process of oilfield production and development. In order to formulate the bitumen, other material that is needed include mineral oil, waste sludge and crumb rubber. The form of crumb rubber is form from discarded tyre. Generally, the tyre rubber is ground to a particulate or crumb prior to adding it to bitumen. This form of the tyre rubber is called Crumb Rubber and the mineral oil is used as the medium to heat up the crumb rubber until it is melt and dissolved. The main objective in this experiment is to formulate and identify the best ratio of the bitumen produced. The method that is used to formulate is heating and mixing process which is being conducted inside the fume hood. So that it can absorb the fume released when the process is conducted. The key parameter during the process is weight of the sample, temperature, time and the speed of the mixer (rpm). Once it is produced, then the sample need to analyse based on the density 15°C using ASTM D70 method, viscosity test by using ASTM D2170, penetration @ 25°C test which by using ASTM 5 method and softening point test which is by using ASTM D36 method. The best ratio by far is (1:2:1.2) formulation by having viscosity of 93 centipoise, density of 1.0398 Kg/L, softening point which is at 62°C and penetration which is at >40 mm of penetration. The sample that is formulated were then being compared with the actual bitumen sample

Keywords: Bitumen, Waste Sludge, Tyre Rubber

INTRODUCTION

Bitumen plays an important role as it benefit to the society in terms of infrastructures which is widely used in the world. Bitumen is a naturally occurring mixture of various organic liquids, it is black, highly viscous and sticky material which is the first oil product that utilized by humans due to its adhesive and cohesive properties [1], [2]. It is also can apply in several of application that includes road construction, roofing application, paving roads, waterproofing products, building material and etc. It is estimated that the current world use of bitumen is roughly about 102 million tonnes per year. About 85% of all the bitumen produced is used as the binder in asphalt for roads. It is also used in other paved areas such as airport runways, car parks and footways [3]. Typically, the production of asphalt involves mixing sand, gravel and crushed rock with bitumen, which acts as the binding agent. Other materials, such as polymers, may be added to the bitumen to alter its properties according to the application for which the asphalt is ultimately intended. A further 10 % of global bitumen production is used in roofing applications, where its waterproofing qualities are invaluable. The remaining 5 % of bitumen is used mainly for sealing and insulating purposes in a variety of building materials, such as pipe coatings, carpet tile backing and paint [4].

Based on industry survey, there is a lot of method to formulate bitumen such as by refining crude oil using

fractional distillation, solvent extraction, hydrodesulphurization and hydrogenation. The most common method and widely used in industry to form bitumen are by using fractional distillation where the bitumen is obtained by vacuum distillation or vacuum flashing of atmospheric residue from the vacuum distillation column [5], [6]. However by performing this process it required highly cost and somehow it effecting the environment where the fumes and vapours that forms in the distillation process can cause physical effects such as irritation of the eyes, nose, and respiratory tract in animals and humans. In simplicity bitumen can also being produced and formulate by using waste sludge where it also requires crumb rubber and mineral oil.

Waste sludge

Waste sludge is a substance that consists of mineral oil solid waste, which includes oily sand, tank bottoms and other three kinds of sludge from refineries such as dissolved air flotation scum, excessively activated oily sludge and bottom sludge of oil from pools [7], [8], [9]. Generally, the oily sludge accumulates in large quantities as a dumped waste. This mixture of oil, solids, and water deposited at the storage tank bottom is known as waste oily sludge [10]. It is removed during tank cleaning operations and sent for further treatment or disposal [11]. Both the upstream and downstream operations in petroleum industry can generate a large amount of oily wastes. The upstream operation includes the processes of extracting, transporting, and storing crude oil, while the