# CHAPTER 1

# INTRODUCTION

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Recently there has been rising concern in the global environmental problems, particularly in the global warming issues. This has led to intense research and development of a large diversity of energy saving technologies. Since fossil fuel is the main source of carbon dioxide which emits causing the global warming, it can be replaced with biogas from digesting sludge. One way of using wastewater treatment for global warming counteraction is subrogating fossil fuel with energy from biogas produced from wastewater treatment and also this can share in reducing energy consumption.

The sewage sludge treatment has a substantial purpose to recycle resources without providing harmful substance to humans or environment. Also, to avoid the deposit sludge on landfill since the degradation of its organic constituents on landfill produces carbon dioxide and methane which recirculates carbon back to the atmosphere and causes global warming (Wang et al., 2010). Sewage sludge is produced during wastewater treatment in large amounts. It produced as the single largest residual product of the sewage treatment process. This amount is growing hugely with the increase of wastewater treatment. The sludge is disposed of by throwing on land after incineration or dropping on oceans. But since it is in increasing and have dangerous effects on the environment including humans, animals, plants, soils, ground water and air, there are strict legislations related to that. So it must be a proper treatment of the sludge (Arthurson, 2008).

Biological processes like aerobic and anaerobic digestion are most used for sludge degradation, which not only minimize the disposed sludge volume, but also produces valuable methane gas (during anaerobic digestion) and high quality bio-solids for soil application. Aerobic digestion is economically non viable to treat big quantities of sludge, due to the large capacity aerator which consumes high energy resulting in very expensive process (Oh, 2006). Therefore anaerobic process is the most implemented in medium and massive wastewater treatment plant. Anaerobic disintegration of organic matter particles and macromolecules undergo to series of four steps which are namely hydrolysis, acidogenesis, acetogenesis, and methanogenesis. In the sewage disintegration condition, the hydrolysis has been identified as the rate limit step. So, the pretreatment of sewage sludge using chemical, mechanical, or thermal disintegration could ameliorate the following anaerobic degradation. The sludge retention time in the anaerobic digestion reactor can be reduced from the standard of 15-30 days, if sludge disintegration is utilized and the hydrolysis reaction is accelerated. Consequently, more investment and operating costs can be saved due to the reduced reactor volume, which allows more compact plants (Drinan, 2001).

Waste water bio-solids are mainly composed of highly putrescible volatiles compared to forest and agricultural bio-solids. It is very important to treat the raw sewage sludge biologically assuring an ensuing environmentally safe utilization and disposal. The standard stabilization process for waste water solids is the anaerobic fermentation. In this process a net reduction of the bio-solids mass and volume is realized (Arthurson, 2008). Anaerobic disintegration takes place as a series involve molder of biodegradable matter by microorganisms in deprivation of oxygen. It is utilized for domestic or industrial aims of dumb management and/or energy production. Anaerobic disintegration is the solitary in the renewable energy methods that is quite thoughtful, totally scalable, and produces an energy production that can be saved directly. Anaerobic disintegration is most applied as a renewable energy provenance due to the release of the methane and carbon dioxide fully loaded biogas during the process which is proper stock for energy generation and fossil fuels replacement. The nutrient-rich output digestate can be utilized as fertilizer (Nickel, 2002). It is highly potential that anaerobic digestion will be carried out growingly at minimal levels if the technology is moreover integrated as a consort to different scalable renewable choices like wind and photovoltaic solar cells. But due to the shortages of the anaerobic the membrane separation process has been introduced to overcome the anaerobic limitations.

The separation by means of membrane includes molecules transportation across a film. This is usually a solid and can also be a liquid. The membrane can be a homogeneous material or a composite material with a very thin active layer supported by a stronger but more porous material. Membrane processes have received considerable interest during recent years, and many new research programs have begun during the last 10 to 20 years. This growth in interest in membranes has resulted largely from improvements in membrane technology. Interest in membrane technologies seemed to jump significantly with the discovery (or development) of effective reverse osmosis membranes in the 1960s for desalination (Blackman, 2001). The technology of membrane bioreactor (MBR) has great chance in several varieties of applications which involve municipal and industrial wastewater treatment, groundwater and drinking water regression, solid dumb management, and odor control. The feasibility of this technique has been proved via numerous studies in pilot and bench scale. Wide world full scale processes are operational and substantial growth in the number and volume is in prospect for the near future (Cicek, 2003). Membrane bioreactor systems have stood out as an efficient solution to transforming change wastewater into high quality discharge appropriate to be disposed into the environment and furthermore into a reusable product. The membrane have disadvantage of fouling which is a major problem since cost high expenditure and waste a lot of time for cleaning. Incorporating ultrasound to