CHAPTER I
INTRODUCTION

Presently, there are various environmental problems in the world and one of the most important issues is water pollution. There are many apparel industries in each country which produce wastewater from the dye compound in the process of dyeing. Every apparel industries in the world produce wastewater which has mixtures of color dyes from the dying process. By combining the wastewaters from all apparel industries would cause major water pollution problems. The wastewater from dyeing contains hydrolyzed reactive dyes, organic substances, textile fibers and electrolytes. This report will focus on decolorizing of wastewater from dyeing process by using photo-catalysts.

There are several techniques to decolorize the wastewater to clean and clear water which are biological technique, chemical technique and physical technique. The most interesting technique is the chemical technique because it is highly efficient for wastewater treatment; however, they are costly and required high energy consumption. For this technique, the material used is metal nanoparticle catalysts. The metal nanoparticle catalysts are usually directly in contact with the wastewater then it was exposed to either visible light or UV light to give the energy to decolorize the wastewater (Pouretedal and Kadkhodaie, 2010). The metals could then be removed by filtration. There are many metals oxide such as Zinc oxide (ZnO_2), Titanium oxide (TiO_2), and others which are widely interested but in this work will focus on Cerium oxide (CeO_2) or Ceria. Cerium oxide was used in many applications such as solid electrolyte, polishing agent, and automotive exhaust catalyst because of its high oxygen storage capacity (Essex et al., 2013, and Peiretti, Tiscornia, and Miro, 2013). The properties of CeO_2 will be improved if CeO_2 was used in the form of nanoparticles. CeO_2 was synthesized using the precipitation technique by using polyelectrolytes as capping agent and Sodium carbonate (Na_2CO_3) as precipitant. This work consists of two parts. The first part involves the synthesis of CeO_2 with polyelectrolytes as capping agents. The polyelectrolytes used in this part are poly(diallyl dimethyl ammonium chloride) (PDADMAC),

poly(styrene sulfonate) (PSS), poly(styrene sulfonate-co-maleic acid) (COPSS) and poly(acrylic acid) (PAA) to get smaller size of CeO_2 with more homogeneity. The second part is the synthesis of CeO_2 with Ag nanoparticles to improve the photo-catalytic activity because Ag nanoparticles can prevent the recombination reaction and enhanced photon harvest of CeO_2 (Benzia, 2014). Then, the CeO_2 produced was used to decolorize methyl violet dye under UV irradiation. When the catalyst received enough energy from the UV light, the catalyst will generate positive and negative charges which can produced radicals that can reacts with the dye in the waste water i.e. dye degradation. As a result, produces clean and clear water.

The purpose of this work is to synthesize the CeO_2 by precipitation technique using polyelectrolytes and Na_2CO_3 as capping agent and precipitant, respectively, and to synthesize the CeO_2 with Ag nanoparticles. Additionally, to study on the CeO_2 then use it to decolorize the waste water under UV irradiation