NEW EMULSION SYSTEM - POLYMERIC "WATER IN WATER" EMULSION

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Synopsis

Polymerization reaction of sodium acrylate (AA-Na) in the presence of poly (ethylene glycol) (PEG) was studied. A new "water in water" emulsion formed when the mol ratio of PEG and poly (sodium acrylate) (PAS) was >1:1. Since this polymerization method gives high molecular weight polymer although the reaction product is low in viscosity, it is useful in obtaining water soluble polymers for such use as a thickener and flocculant.

INTRODUCTION

The present study concerns a new product of water-soluble polymers, i.e., a polymeric "water in water" emulsion. Water-soluble polymers such as poly (sodium acrylate), poly (acrylamide) and poly (dimethylaminoethyl methacrylate), are generally obtainable in three different forms: powder, aqueous solution and water in oil emulsion.

The most conventional method for producing these water soluble polymers is known as the solution polymerization method which uses water as solvent. This method offers an advantage as a high molecular weight polymer can be easily obtained. However, the heat of reaction is difficult to remove since the viscosity of the reaction product increases markedly, rendering stirring difficult to perform and results in a jelly-like material. The jelly-like polymer is very difficult to handle, and to turn it into powder, complex steps such as drying and pulveriza-
tion are required. This water soluble polymer in powder form is normally again dissolved in water before use. The use of the reaction product in the form of polymer solution without pulverizing it requires that its molecular weight and concentration be lowered. A water in oil type emulsion is free from such need but its use is restricted as it contains an organic solvent insoluble in water.

In our investigation, we attempted to produce an emulsion system having no such defects by using water alone as solvent. Mario, et al.¹) tried to prepare a "water in water" emulsion by mixing three water soluble polymer solutions, [poly (oxyethylene), poly (2-vinylpyridinium chloride) and co-poly (2-vinyl pyridinium chloride)-poly (oxyethylene)] and developed a comparatively stable system.

We will describe the success we had in developing a new emulsion system, or more specifically, a polymeric "water in water" emulsion system obtained by polymerizing sodium acrylate in the presence of PEG.

EXPERIMENTAL

Material

Commercial grade of poly (ethylene glycol) (PEG) without any purification.

A commercial grade of sodium acrylate (AA) was neutralized with sodium hydroxide and purified through a column of activated charcoal. The sodium acrylate (AA-Na) solution thus obtained was used as monomer solution, and a reagent grade of ammonium persulfate (APS) and triethanolamine (TEA), as polymerization initiator.

Polymerization

Typical polymerization reaction was carried out as follows: a 500 ml flask, equipped with a stirrer, reflux condenser and nitrogen inlet tube, was charged with 83.3g of the AA-Na solution of 36.0 wt% and 15g of PEG 20,000 to be mixed to form a solution and 92.7g of water was added. While purging the inside of the flask with nitrogen gas, 4.5g of a 1% APS aqueous solution and 4.5g of a 3% TEA aqueous solution were added as polymerization initiators. The polymerization was performed at 40°C and terminated in