CHAPTER I

INTRODUCTION

1.1 Background of the Invention

The past two decades have seen a major growth in the use of synthetic polymers as materials for construction, insulation, packaging, upholstery and transport applications. Unfortunately, this period has also seen a dramatic increase in the number of serious fires, and the number of deaths and injuries in fires has continued to rise. Fire deaths are normally violent in nature, and smoke inhalation, not fire itself, is the killer that accounts for over 80% of fire deaths [1]. Therefore, recent developments in fire testing have placed great emphasis in developing products that have low flame spread properties and are low smoke producing.

The use of flame retardants in polymers has increased dramatically in recent years, in parallel to the growth of the plastics industry. It is estimated that in excess of 400,000 tonnes of such additives are currently used worldwide per year, in a market that is expanding by at least 6% pa.

Acrylonitrile-butadiene-styrene (ABS) thermoplastics offer a good balance of physical and mechanical properties such as good abuse resistance, heat resistance, moldability, stain resistance, chemical resistance, and surface hardness. Because of their properties and their moderate cost, they have been chosen for use in a wide range of applications. They are used by telephone and automotive manufacturers who require materials with high impact strength. Manufacturers of boats utilize these materials because of their high strength to wight ratios and their deep draw thermoformabilities. Manufacturers of luggage, appliance, sporting goods, safety equipment, and toys utilize these mateials because of their light weights and their flexural and high impact properties [2].

ABS plastics are widely used by manufacturers of business machines, building components, television components and institutional products. For many of these uses the ABS plastic must be flame-retarded.

In the prior art, certain halogen-containing compounds were recommended for flame retarding ABS plastic. Because bromine-containing compounds have been regarded as better flame retardants, several brominated additives have been recommended for ABS, but they have found limited use in ABS because at accepted levels of addition they proved ineffective and expensive [3-5], so that the addition of synergists is making the process uneconomic for most applications. For ABS, antimony trioxide is now by far the highest volume synergist flame retardant, however this flame retardant systems are known to cause an increase in the amount of smoke and toxic/corrosive gases generated by plastics if they burn [6]. Recent studies have indicated that certain gaseous combustion products, including CO and HCN, can cause very rapid incapacitation even at relatively low concentrations. Consequently, much research is being carried out into the development of flame retardant formulations which incorporate smoke, toxic gas-suppressant properties and safer chemical additives.

At present time, inorganic tin compounds find a relative use in a number of natural and synthetic polymers. They appear to have certain adventages over the existing commercial additives, namely : [7]

non-toxicity,

effectiveness at low incorporation levels,

no discolouration of substrate,

marked flame-retardant synergism with halogen compounds,

little apparent effect on physical properties,

combined flame retardancy and smoke suppressancy,

wide range of applicability.

In view of these factors, it was suggested that the possible use of tin chemicals as flame retardant and smoke suppressant should merit serious considertion, In addition, the International Tin Research Institute (I.T.R.I.) has demonstrated the effectiveness of zinc hydroxystannate and zinc stannate as flame retardant additives for halogen containing polymer formulations.

1.2 Objectives

1. To study the use of zinc hydroxystannates and zinc stannates as synergist flame retardants for acrylonitrile-butadiene-styrene copolymers.

2. To compare the synergist flame retardant effects of tin compounds with antimony trioxide which is now used for commercial ABS.

1.3 Scope of the Investigation

The flame retardance of plastic material can be determined by many methods. In this research, the test is by measuring the minimum concentration of oxygen that will just support combustion (LOI test). The necessary procedures may be as follows ;

1. Preparing the specimens of ABS after blending with flame retardant by the following procedure :

- Blends ABS and flame retardant in the Two-Roll Mill and grind into chips.

- The chips are injection molded in order to provide specimens for testing.

2. Varying the ratio of brominated compounds to tin compounds so as to attain the appropriate LOI value, as good as commercial ABS, and compare with the use of antimony trioxide for synergistic flame retardant.

3. Investigating the properties of ABS composition such as notch impact strength, tensile strength, hardness and melt flow index.

4. Analyzing the quantities of elements after burning the ABS composition by Neutron Activation Analysis (NAA) and thermal analysis can provide details of various individual stages occuring during the breakdown of polymers under the action of heat and can provide useful information regarding the mode of action and effectiveness of flame retardant additives.