

## CHAPTER I

### INTRODUCTION

Every fire is a potential killer. Delaying the time from ignition to a full blown blaze even by just minutes can mean vital extra escape time and the difference between survival and death. In 1996 there were 50,000 accidental house fires in the UK, resulting in 500 fatalities.<sup>1</sup> According to the London Fire Brigade, just three minutes after ignition a fire can become a full blown blaze. Death from asphyxiation is likely to occur within four minutes.

Today, flame retardants are used in a whole range of materials, from plastic coating for wires and cables, in foams and textiles for furniture and upholstery in adhesives and coatings, to wood, paper and construction materials. Flame retardants can and do save lives, both by preventing fire from starting and by increasing the escape time in the event of a fire up to 15-fold.

The control of flammability of commercial polymers has been receiving considerable global attention during the last two decades. Among various desirable properties of fire retardant polymers, increased thermal stability is one of the key requirements for their satisfactory behavior under extreme environmental conditions.

Improvement of flame retarding performance of polymeric materials can be achieved by 2 methods. The first method used industrially is to introduce flame retardant substance as an additive of the polymer of interest. The advantage of this method is the ease and convenience of adjusting the type and amount of the additive of choice. However, since flame retardant substance is only mixed with the polymer and a physisorption force is not a strong one, the additive may be lost over a period of time under certain conditions. In addition, other properties of polymer may be changed since the additive can also act as a plasticizer.<sup>2</sup> Alternatively, flame retarding properties can be introduced into the polymer backbone by means of chemical bonding. In other words, polymerization of monomeric materials containing flame retarding moiety would result in the desired materials.<sup>2-6</sup> In this case, some physical properties may still be changed such as strength and flexibility. Also, it might be harder to control other mechanical properties. However, there have been many reports

showing that polymers synthesized by this method having superior thermal properties and flame retardancy to those prepared by the former method. Thus considerable researches are being done into developing flame retardants for new applications or to offer improved performance over existing products, particularly in terms of environmental benefits.

### **Research goal**

Polyphosphonates and polyphosphates are of commercial interest because of their flame retarding characteristics and their potential as high performance plastics.<sup>7</sup> For these reasons, the objects of this research are:

1. To synthesize new class of polyphosphate and polyphosphonate esters
2. To study factors affecting weight average molecular weight ( $\bar{M}_w$ ) of the polymers
3. To study the structure-thermal properties relationship, and the structure-flammability correlation



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