PRELIMINARY EVALUATION OF TEDMA/HEMA + HAP COMPOSITES AS BONE SUBSTITUTES AND DRUG CONTROLLED DELIVERY MATRIXES

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***Abstract*— Copolymeric composites of tetraethylenglycol dimethacrylate and 2-hydroxyethyl methacrylate with hydroxyapatite load were studied. It was demonstrated that doesn't exist a tendency to justify the behavior of the work and setting times of the studied materials cause probably by inhibitor absence. Similar values of enthalpy reactions were obtained for all the compositions according to the literature reports. A strong dependence of the composition exists in case of mechanical properties, diminishing the compression strength with the increase of the hydrofilicity. In a same way, the little swelling of the samples is demonstrated and therefore, the non participation of the diffusion like delivery mechanism. It was calculated the quantity of liberated drug which influences notably in the mechanical properties of the material and some parameters that suggest it mechanisms type dissolution-diffusion and/or migration to guide the drug delivery.**

***Keywords*— composites, hydroxyapatite, acrylic monomers, drug delivery systems, mechanical properties**

I. INTRODUCTION

The hydroxyapatite, HAP, is a fundamental mineral component of the human bone. The preparation of calcium phosphates cements that form *in situ* HAP have been studied as a possible solution to bone traumatologies that have been increased in our days. Composites of PMMA with HAP or dense and porous blocks of calcium phosphates with diverse morphologies have enlarged too (Arcís, 1998 and Bowen *et al.*, 1978). It was demonstrated that an increase in the volume fraction of hydroxyapatite from 10 to 50 % produced an increment in the compression strength of the composite (Guild and Bonfield, 1993). This fact enlarges the original properties of the hydroxyapatite in order to apply in zones of high mechanical charges (Arcís, 1998).

The human skeleton constitutes a novel element in the evolutionary development for its regeneration capacity and the physiologic evolution of tissues formed in embryonic state. Novel synthetic and natural materials have been elaborated for improving this regeneration and restoration capacity. The biomaterials before mentioned can be biodegradable and not biodegradable, and they have advantages and disadvantages (Bowen *et al.*, 1978).

The ideal material for the bone substitution should imitate to the natural bone tissue that replaces it in size, forms, consistency and operation. It should not cause infections neither to cause foreign body response. And should be tolerated permanently by the receiving organism, in other words, it should be biocompatible. As main inorganic component of the skeleton and teeth of most of the vertebrates, the hydroxyapatite is one of the few materials that doesn't form a reaction when being implanted in the live bone tissue. That is the reason of the great interest wakened up by the ceramic and other materials based on them as implant object (Bowen, 1979).

There are a large variety of degradable polymers available for use in surgery which are generally based on blends and copolymers of poly(L-lactide) and poly(L-glycolide) (Knowles, 1993). Different poly(2-hydroxyethyl methacrylate)/polycaprolactone hydrogel composite systems reinforced with polyethylene therephtalate fibres have been investigated for potential use as invertebral disc prostheses (Ambrosio *et al.*, 1998).

Also, copolymers of 2,3-dihydroxypropyl methacrylate and 2-hydroxyethyl methacrylate have been studied as a interconnected network in order to use as possible implant material (Gates *et al.*, 2003a and Gates *et al.* 2003 b). Other polymers was filled with HAP through a method based on spontaneous precipitation of HAP in aqueous suspensions of sulphonated polysulphone polymers particles (Spanos *et al.*, 2002)

Another group of researchers have been proposed investigations about composites HAP-PMMA. They determine wether the incorporation of HAP in a PMMA matrix would enhance the biological properties of osteoblast response as compared to PMMA alone (Moursi *et al.*, 2002).

In this work the results of a preliminary study of a self-cured composite based on a copolymeric mixture of tetraethylenglycol dimethacrylate (TEDMA) and 2-hydroxyethyl methacrylate (HEMA) loaded with HAP are presented. It tries to prove the influence of the copolymeric composition in the work and setting time and enthalpy polymerization. Also it was determined the effect over mechanical properties and the controlled delivery capacity of the system as drug support matrix.