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## Evaluation of some pastes used for

### Gap filling of archaeological bones

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#### Abstract

Transmitted and non-transmitted bores, fractures and sometimes holes are the common aspects of deterioration that can be found in archaeological bones in excavations and storehouses. The factors that cause these forms of deterioration may include biological factors, improper storage, human errors, etc. This study focuses on the evaluation of some pastes used in gap filling of bones in order to verify their effectiveness in the treatment of bone artifacts and to develop them in the future. Change of color, change in the chemical structure, mechanical properties measurement (compressive strength, tensile strength and elongation), wettability, density, porosity, water absorption and investigation of the surface morphology were used to evaluate the pastes used. The results revealed that the paste No. 2 (Paraloid B-72 with glass micro-balloons) was better than the paste No. 1 (Paraloid B-72 with  $\text{CaCO}_3$ ) and the paste No. 3 (beeswax, shellac, sawdust, turpentine and 6 ml of tea tree oil) in most properties.

**Keywords:** Bone, gap filling, UV Spectrophotometer, FTIR, mechanical properties, SEM. Physical properties

#### 1. Introduction

Bone consists of two structural components: inorganic mineral, calcium hydroxyapatite  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ , and organic material which is made up of collagen, non-collagenous protein, lipids, mucopolysaccharides and other carbohydrates<sup>[1-5]</sup>. Its composition varies considerably with age and type of bone. Whole cortical bone is approximately 69% inorganic, 22% organic, and 9% water. Hydroxyapatite  $\text{Ca}_5(\text{PO}_4)_3\text{OH}$  compound is considered to be a highly insoluble compound<sup>[6-7]</sup>.

Bone becomes unstable when it is removed from the body because it moves from a relatively closed environment to an open one and can be broken down over time through numerous processes, including physical breaking, decalcification, and dissolution due to acidic soil and water<sup>[12]</sup>.

After death and burial, changes begin to occur in bones which are the result of several factors such as physical, biological, and cultural processes<sup>[13]</sup>. These changes in the physical properties are contemporaneous with chemical changes which occur in the organic and inorganic bone constituents. Bone may be altered and may change colour as a result of temperature or moisture, soil composition, sediment pH, and the changes may occur in the bone tissue in the form of ionic substitution<sup>[14]</sup>. In dry conditions,

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