

## Preparations of Glasses for Use in Dental Applications.

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### Introduction

Dentistry has developed intensively both in the area of reconstruction, prevention and aesthetics. Restoration materials such as silver amalgam and other cast alloys already existed. However, concerns associated with exposure to mercury for both the patient and the healthcare professional [1] and aesthetic problems led to the search for alternative materials that gather the following characteristics: be bioactive, anti-cariogenic, adherent, aesthetic and relatively inexpensive. Glass ionomer cements (GIC) exhibit advantageous properties using a fluoride release mechanism, which is a factor of protection against tooth decay, and its adhesiveness facilitates the restoration of cavities without prior preparation [2]. In addition, this material has physicochemical properties similar to dentin. This study aimed the preparation of two types of GIC, with and without fluoride in its composition, obtained by the sol-gel method, V1Ti (47% SiO<sub>2</sub>:15% CaO : 29% Na<sub>2</sub>O : 7% P<sub>2</sub>O<sub>5</sub> : 2% TiO<sub>2</sub>) e V1TiF (47% SiO<sub>2</sub> : 15% CaO : 29% Na<sub>2</sub>O : 7% P<sub>2</sub>O<sub>5</sub> : 2% K<sub>2</sub>TiF<sub>6</sub>). Here we compare their properties to observe the influence of fluoride in the integrity of those materials. The synthesized samples were characterized by Sieve Analysis, surface area measurement (BET), SEM, FT-IR spectroscopy and DTA. The setting times and solubility of the cements were determined.

### Results and Discussion

There is a decrease in the average particle size and in the specific surface area of the samples after calcination at 600° C (V1Ti, 34.11 µm, 35.5486 m<sup>2</sup>.g<sup>-1</sup> e V1Ti-c, 31.19 µm 9.3967 m<sup>2</sup>.g<sup>-1</sup> and V1TiF, 31.68 µm ,150.7413 m<sup>2</sup>.g<sup>-1</sup> V1TiF-c, 24.85 µm, 27.5618 m<sup>2</sup>.g<sup>-1</sup>). The surface area of the sample V1TiF-c is close to the one of standard glass ionomer used (28.7484 m<sup>2</sup>/g). Through images obtained by SEM it is possible to observe larger agglomeration of the particles for the samples V1Ti and V1TiF after calcination, which agrees with the results above presented. In the FTIR spectra of non-calcined and calcined samples is possible to observe band broadening between 3000 cm<sup>-1</sup> and 3700 cm<sup>-1</sup> corresponding to the stretching OH bonds. Also, between 500 cm<sup>-1</sup> and 1500 cm<sup>-1</sup> relative to the stretching of C-C bonds and bands on the stretch of CH bonds between 1500 cm<sup>-1</sup> and 2000 cm<sup>-1</sup>. In the calcined samples, the bands intensity decrease due

to elimination of adsorbed water, residual organic compounds, and nitrates. It could be observed bands at 400 cm<sup>-1</sup> and 500 cm<sup>-1</sup> attributed to Si-O-Si linkages, which are the active sites for reaction with the acid forming the cement. After the reaction of the powder (ionomer) with the acid solution (polyacrylic acid) it was observed bands at 1600 cm<sup>-1</sup> e 1650 cm<sup>-1</sup> attributed to stretching COO bond. The presence of the bands between 1350 cm<sup>-1</sup> and 1400 cm<sup>-1</sup> was attributed to the symmetric and asymmetric stretching bond of the -COO<sup>-</sup>, and between 1250 cm<sup>-1</sup> and 1300 cm<sup>-1</sup> to the symmetrical stretching of CO and CC bonds and asymmetric bonds COC what confirmed the interaction between the phases forming the GIC. The setting times obtained for the GIC studied was 5 to 7 min. Thus, It was detected that the fluoride and the ratio powder / liquid had influence in this parameter. Moreover, the solubility of the samples is ruled by the presence of fluoride.

### Conclusion

It was successfully synthesized two new GIC with and without fluoride in composition from different precursors by the sol-gel method. Comparing the setting times of the synthesized cements to commercial cements there is similar setting times for the proportions 1:1 powder:liquid although the standard cement used has been constituted by aluminum silicate and the synthesized cements were based on titanium silicate. The V1TiF-c samples have formed GIC more readily than the V1Ti-c. Such behavior was attributed to a larger surface area that increases the reactivity of the glass.

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