

PURPOSE

The aim of this study was to determine the physicochemical and biological properties of Chitosan (Ch), chitosan-lysine (Ch-K), and chitosan-polyethyleneimine (Ch-PEI) sponges as a hemostatic material in dental treatments.

METHODOLOGY



Figure 1. Methodology for chitosan (Ch), chitosan-lysine (Ch-K) and chitosan-polyethyleneimine (Ch-PEI) sponges.

RESULTS

XPS detected the amount of nitrogen (N) and oxygen (O), which increased in sponges containing PEI due to the multiple amine bonds present (Table 1).

Samples	Atomic percentage (%)			
	C	O	N	Na
Ch	72.05	19.91	2.97	5.07
Ch-K	65.29	26.31	5.22	3.18
Ch-PEI	52.53	30.98	6.29	10.2

Table 1. Elemental composition (atomic %) of the sponges.

FTIR (Figure 2) showed the characteristic bands for Ch, Ch-K, and Ch-PEI. The change in intensity of the bands located at 1646 cm^{-1} and 1575 cm^{-1} and the appearance of the 816 cm^{-1} band were attributed to the crosslinking of PEI with chitosan.

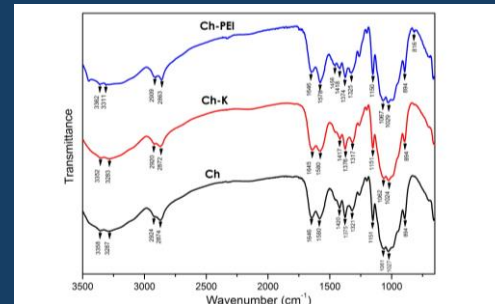


Figure 2. FTIR spectrum of Ch, Ch-K, Ch-PEI sponges

The sponge's decomposition temperature (T_d) was recorded between 272°C and 283°C. The decomposition temperature of chitosan with lysine occurred at 272°C, having a 50% mass loss at 373°C (Figure 3).

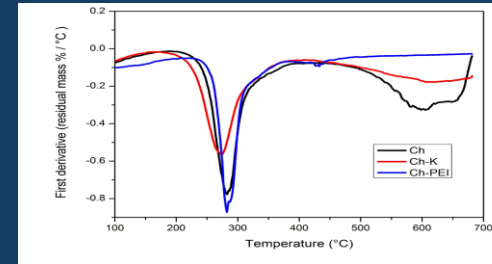


Figure 3. Thermogravimetric analysis (TGA), Ch, Ch-K, and Ch-PEI sponges

Through SEM, the morphology of porous samples was observed. Micropores were observed in the spongy materials that originated from interactions of hydrogen bonds and amide bonds between chitosan, lysine and PEI (Figure 5).

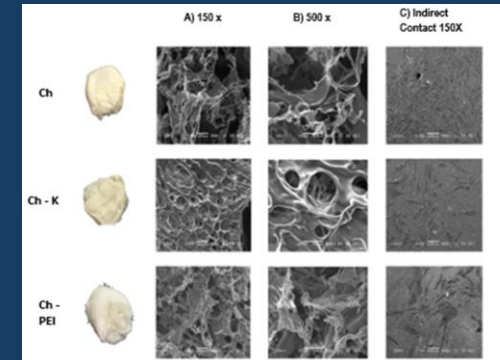


Figure 5. SEM surface morphology of chitosan sponges

Regarding the cell viability test, the spongy materials showed a higher percentage of cell viability ($p=0.003$) (Figure 6).

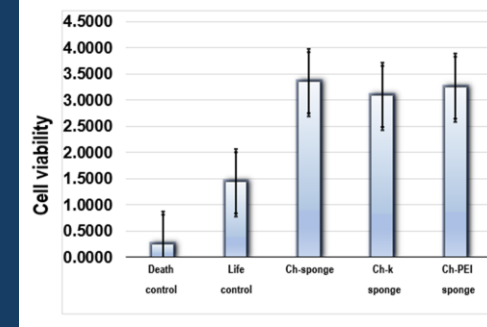


Figure 6. Viability of fibroblasts in indirect contact in Ch, Ch-K and Ch-PEI sponges.

Figure 7 shows that the unneutralized chitosan sponge was the one that presented the greatest effectiveness in coagulation time.

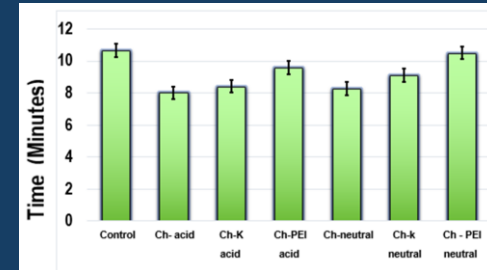


Figure 7. Coagulation times of Q, Q-K and Q-PEI sponges

CONCLUSION

Ch, Ch-K, and Ch-PEI sponges have the physicochemical and biological qualities necessary to be used as hemostatic materials in dentistry. The chitosan sponge showed better hemostatic and cell viability properties than the other study materials.