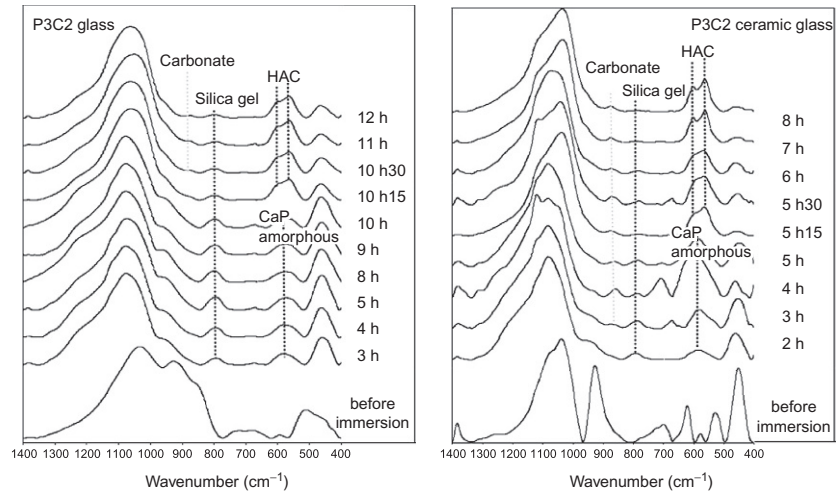

FIG. 3.7 Infrared spectra of P3C2 glass and P3C3 ceramic glass versus soaking time in SBF.

(5) The material obtained was then heat-treated at low temperature (250°C) in order to remove the PMMA and then sintered at 900°C for 3 h with a heating rate of 3°C/min.

(6) The macroporous glass-ceramic presents walls and cavities with a relative density of 95%. The size of the interconnections is about 130 μm, and the mean diameter of the macropores is 490 μm, the pore volume being about 67%.

An X-ray diffraction analysis, as a function of the temperature, revealed that the glass crystallized from 500°C, predominantly in $Na_2CaSi_3O_8$. However, NMR analyses of ^{31}P and ^{29}Si on this glass, treated at 900°C, showed that a vitreous part remained in this material, and that this glass could be assimilated to a glass-ceramic.

In order to verify the application of this material as a bone substitute, tests of in vitro bioactivity were carried out on the initial glass P3C2 and on the glass-ceramic obtained from the P3C2 glass.

Infrared analyses (Fig. 3.7) on the surfaces of samples after soaking in SBF show that the glass-ceramic develops its HCA layer more quickly than glass. Indeed, the apatite was formed after 10 h 15 min soaking for the glass and only 5 h 15 min for the glass-ceramic.

3.3 MIXTURE DESIGNS APPLIED TO THE SiO_2-CaO-Na_2O SYSTEM DOPED WITH P_2O_5 AND CaF_2

3.3.1 Selection of Doping

Taking into account the differing bioactivity results of the SiO_2, CaO, and Na_2O-based glasses obtained by various authors, we decided to apply a mixture design