Supporting Information

Aqueous stability of alumina and silica perhydrate hydrogel: Experiments and computations

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Comparison of the stability of alumina and sodium aluminate perhydrates

Figure S1 compares the air stability of the alumina perhydrate (AP) and sodium aluminate perhydrate (SAP) at two different temperatures. We have conducted a preliminary test in order to find out the more stable matrices. Figure S1 clearly shows that AP exhibits improved stabilities at both temperatures compared to the SAP.

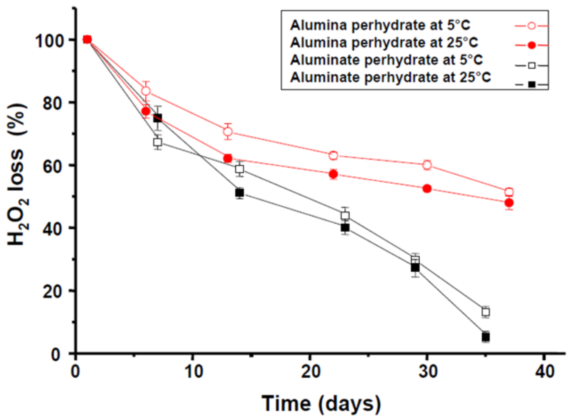

Figure S1: *The rate of peroxide loss as a function of time of AP (red) and SAP (black) in 5 and 25°C. The results represent the average of three measurements.*

XRD studies of alumina perhydrate and alumina hydrate.

Figure S2 shows the xrd diffractions of alumina hydrate and perhydrate that were prepared in the same way. While AP hydrogel is amorphous, the hydrogel of alumina hydrate is crystalline and is composed from Boehmite (92.7%, red symbols) and Bayerite (7.3%, blue symbols).

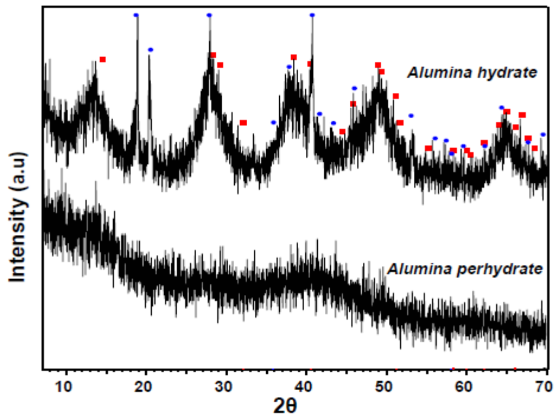

Figure S2: *The XRD patterns of alumina hydrate (upper) and perhydrate (lower)*

Raman spectra of silica perhydrate hydrogel and aqueous solution of H_2O_2

The Raman spectra of 10% aqueous hydrogen peroxide and SP are shown in figure S3. Both spectra have the sharp and symmetric line of (O–O) stretching vibration at 876 cm^{-1}. The small shift to lower energies (compared to 880 cm^{-1} of pure H_2O_2) is due to the hydrogen bonding of the hydrogen peroxide molecules with silica and water molecules.

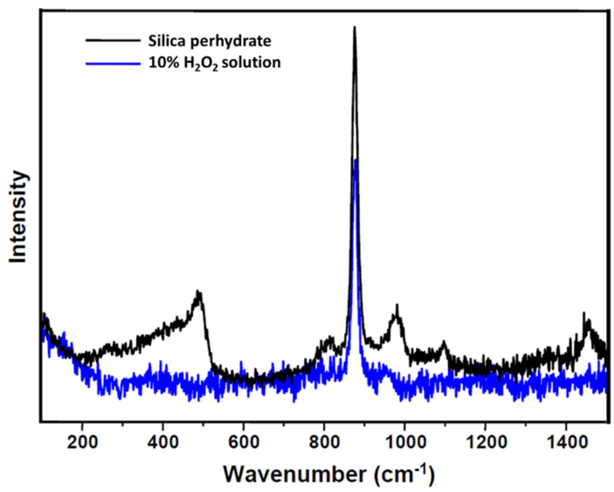

Figure S3*: Raman spectra of SP (black) and 10% aqueous solution of H_2O_2*

TGA of serine perhydrate and sodium percarbonate

The TGA of serine perhydrate and commercial sodium percarbonate (Sigma) are shown in figure S4. Both start to lose their peroxide content at about 75°C and fully decomposed at about 100°C.

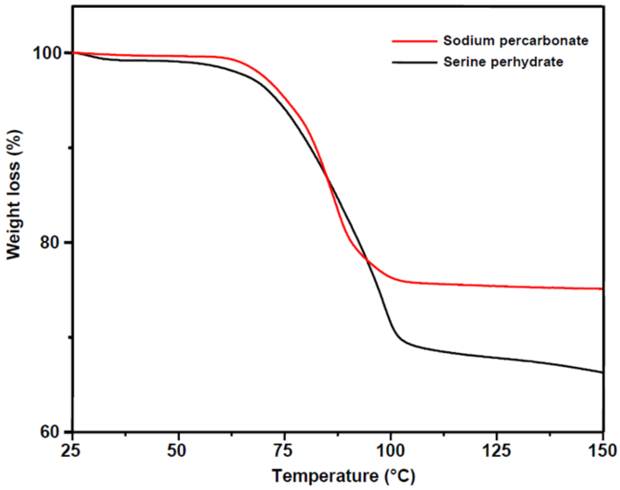

Figure S4: *TGA of serine perhydrate and commercial sodium percarbonate*

HR-SEM images of AP hydrogel after immersion in water

Figure S5 show HR- SEM images of AP hydrogel after 24 hours in distilled water (A) and in tap water (B). In distilled water the dense structure of AP changed to an open sheet-like structure, whereas in the tap water a stabilization effect was observed and the dense structure of the AP hydrogel was maintained.

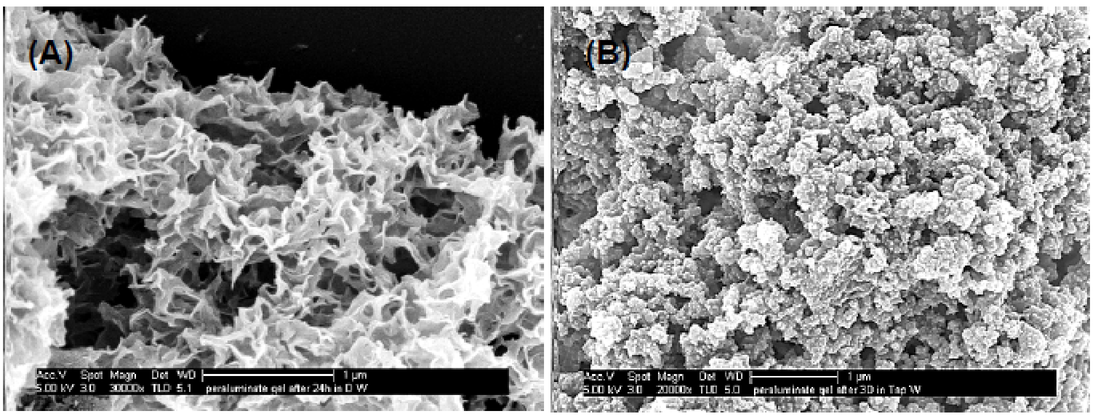

Figure S5: *HR-SEM of AP hydrogel after dispersion 24h in distilled water (A) and tap water (B)*