Supplementary Information, New Journal of Chemistry

Synthesis, Characterization and Application of Modified Acrylamide-Styrene Sulfonate Resin and Composite for Sorption of Some Rare Earth Elements.

Emad Hassan Borai[a], Mahmoud Goneam Hamed[a*], Ahmed Mohamed El-kamash[a], Tharwat Siyam[a] and Gamal Owis El-Sayed [b]

[a]Hot Laboratories Center, Atomic Energy Authority, 13759, Egypt

[b] Chemistry Department, Banha University, Egypt

Influence of the Poly Acrylamide concentration on the polymerization process

The results shown in Fig. S1(a, b, c) demonstrated that the maximum Cu^{2+} ion capacity was achieved at 0.2 % of PAM, i.e. at maximum capacity and the highest swelling degree increases till 0.2 Wt % and then decreases. On increasing the amount of added polymer, he association between the monomer and the added polymer increases, which leads to increase in the extent of crosslinking between the polymer chains of the resin. After 0.2 Wt%, further increase of the crosslinking decreases the capacity of the obtained resin.

Fig. S1-b showed that the swelling degree increases with increasing of the added polymer concentration from 0.1 to 0.2 Wt %. This may be due to possible porosity of particles originated due to template polymerization of SSS onto P(AM).

Fig. S1-c showed that the percent conversion increases linearly with increasing of polymer concentration. The increase in polymer concentration leads to increase the probability of association between the monomer and polymer and increase the concentration of the formed radicals. Consequently, the polymerization process increases.

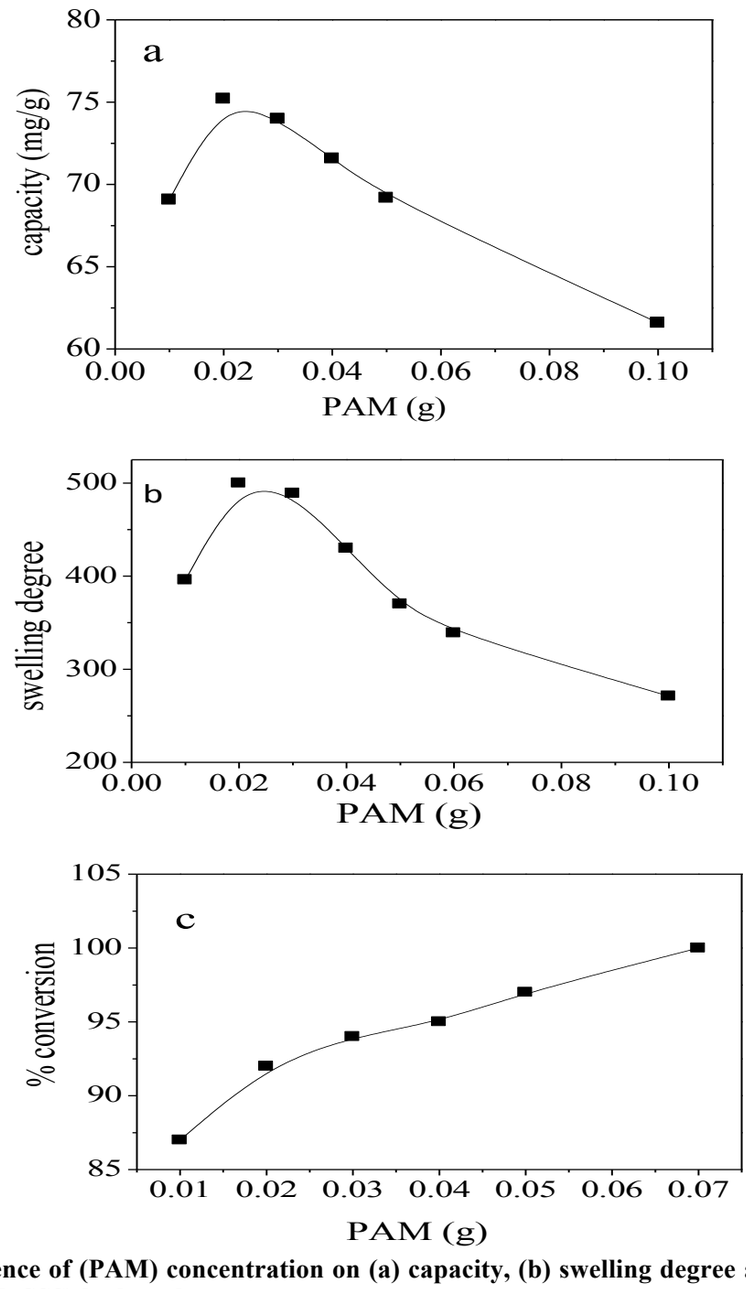

Fig. S1 Influence of (PAM) concentration on (a) capacity, (b) swelling degree and (c) conversion yield of P(AM -SSS) hydrogel.

Influence of irradiation dose on the polymerization of hydrogel.

The Influence of irradiation illustrated in Fig. S2(a,b,c). showed that the capacity increases till 15.0 kGy and then decrease with further increasing of the irradiation dose. The maximum metal ion uptake was achieved at irradiation dose 15.0 kGy, The increase in the capacity of the resin upon increasing the irradiation dose can be attributed to the increase in the degree of crosslinking between the polymeric chains of the resin which, leads to formation of suitable attachments. With further irradiation dose, the decrease in the capacity may be due to the higher increase in the extent of croosslinking to undesired limit that may deteriorate a large number of available sulphonic function groups. In addition, the number of amide groups decreases due to imidation of amide groups.

Fig. S2-b showed that swelling degree decrease with the increasing of irradiation dose, which can be attributed to the decrease in crosslinking between the polymeric chains of the resin and the long diffusion processes from the solution bulk to the resin.

Fig. S2-c showed that the percent conversion increases with increasing of irradiation dose, which, increase the crosslinking and probability of association between the polymer matrix and spreading of free radical.

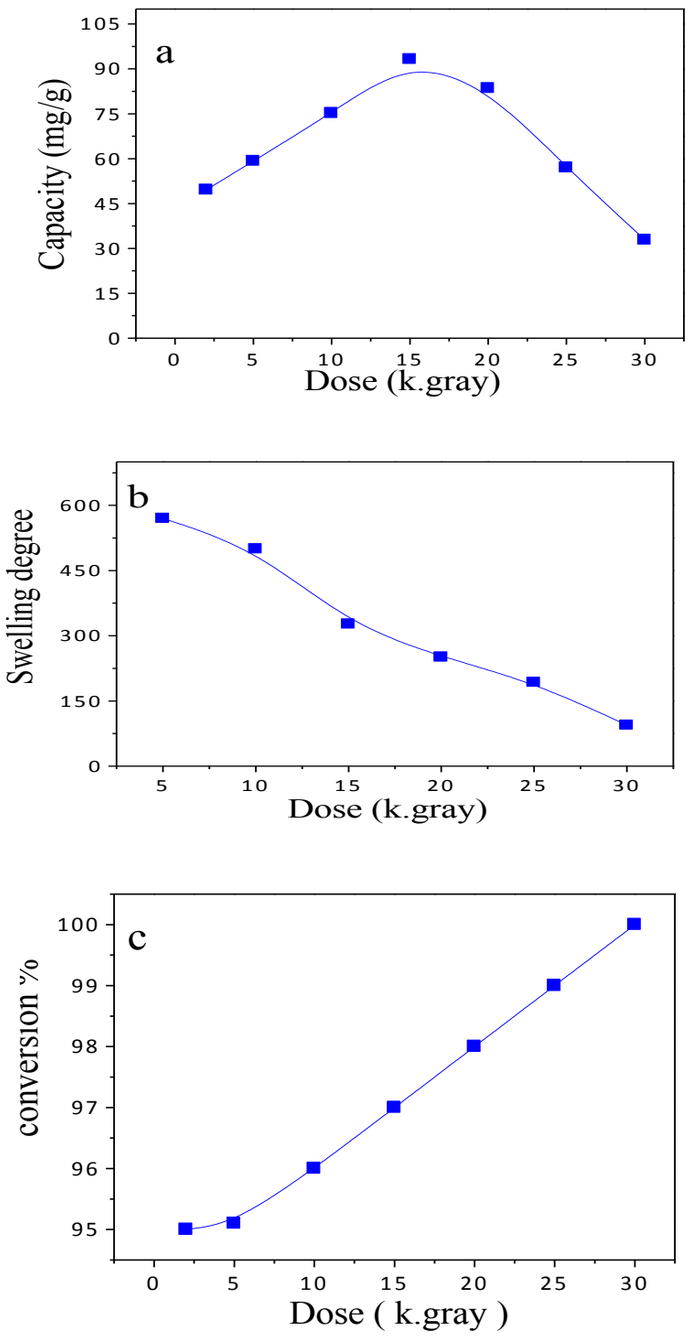

Fig. S2 Influence of irradiation dose on (a) capacity, (b) swelling degree and (c) conversion yield of P(AM-SSS) hydrogel.

Influence of DAM concentration on the polymerization of hydrogel.

The influence of the crosslinker concentration on the capacity of the obtained hydrogel towards (Cu^{2+}) was studied as shown in Fig. S3(a,b,c). Fig. S3-a showed that the capacity increases by inceasing the concentration of DAM till 0.4 wt % then decreases. The increase in capacity is due to the increase of the crosslinking. The decrease in the capacity may be attributed to decrease in the extent of crosslinking between the polymeric chains as a result of interaction of the crosslinker DAM with the functional groups of the polymeric chains. This leads to decrease the number of free function groups for interaction with the metal ions.

Fig. S3-b demonstrated that swelling degree increase with increasing concentration of crosslinker till 0.3 Wt % then decrease with further increasing the concentration of crosslinker. Swelling equilibrium is reached where the polymer refuses to accept more solvent, at this point swelling degree start to decrease.

Fig. S3-c showed that the conversion percentage increases rapidly and then reached to steady state at which, complete conversion was take place. This may be due to increase the crosslinking between the monomer and added polymer of the resin.

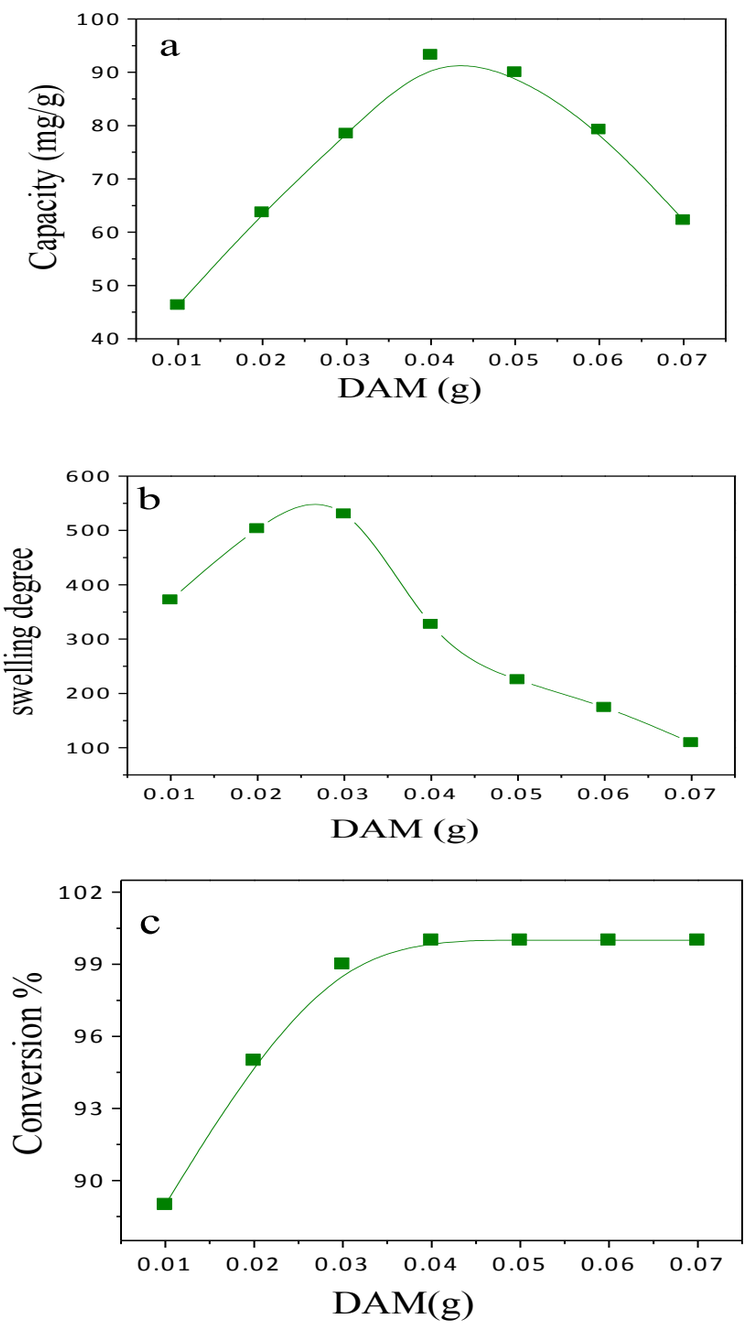

Fig. S3 Influence of the DAM concentration on (a) capacity, (b) swelling degree and (c) conversion yield of P (AM-SSS) hydrogel.