Highly effective and reusable sulfonated polymer nanocomposites for water purification applications

S. Filice[1*], G. Compagnini[2] and S. Scalese[1]

[1]*CNR-IMM, Zona Industriale Strada VIII n.5, I-95121 Catania, Italy*
[2]*Dipartimento di Scienze Chimiche, Università di Catania, Viale A. Doria 6, 95125 Catania, Italy*
**simona.filice@imm.cnr.it*

Hybrid polymeric membranes have been prepared to be used as adsorbent or photocatalyst for dyes (Methyl Orange-MO and Methylene Blue-MB) removal from water [1]. The investigated polymeric material is Nexar^{TM} polymer [2-3], a sulfonated pentablock copolymer (s-PBC), whose structure is formed by tert-butyl styrene, hydrogenated isoprene, sulfonated styrene, hydrogenated isoprene, tert-butyl styrene (tBS-HI-SS-HI-tBS), characterized by high hydrophilicity and a structure that allows high stability in water but also large water absorption. Nexar has been loaded with graphene oxide (GO), and photocatalysts as titania or bismuth oxide in order to increase its mechanical and thermal stability and the adsorption efficiency and to confer it a photocatalytic activity [2-3]. All the investigated materials showed a very large efficiency in removing MB just by absorption processes, eventually enhanced when photocatalytic processes occur. For what concerns MO, Nexar GO composite showed the same efficiency but less toxicity in dye photodegradation with respect to the composite with titania. Furthermore, in the case of the composite with bismuth oxide, the formation of the Bi/Bi_2O_3 mixture confers to the polymer a photocatalytic activity under visible light as shown for MO degradation [3].

The use of polymeric nanocomposites is to be preferred with respect to nanomaterials directly dispersed in water, since these can be easily removed at the end of the process wihout any dispersion of nanoparticles in the enviroment and they can be regenerated and used again. The comparison between the activity of nanomaterials dispersed in water with the activity of the same amount of nanomaterial but dispersed in the polymeric matrix also evidenced a synergic effect of the polymer in increasing the degradation activity of the filler [1-3].

The hypothesis of using sulfonated pentablock copolymer nanocomposites in water purification application is finally confirmed.

[1] S. Filice, D. D'Angelo, S. Libertino, I. Nicotera,V. Kosma, V. Privitera, S. Scalese, *Carbon* 82 (2015) 489-499.
[2] S. Filice, D. D'Angelo, A. Scarangella, D. Iannazzo, G. Compagnini and S. Scalese, *RSC Advances* 7(72) (2017), 45521-45534.
[3] D. D'Angelo, S. Filice*, A. Scarangella, D. Iannazzo, G. Compagnini, S. Scalese, *Catalysis Today* 321-322 (2019) 158-163.