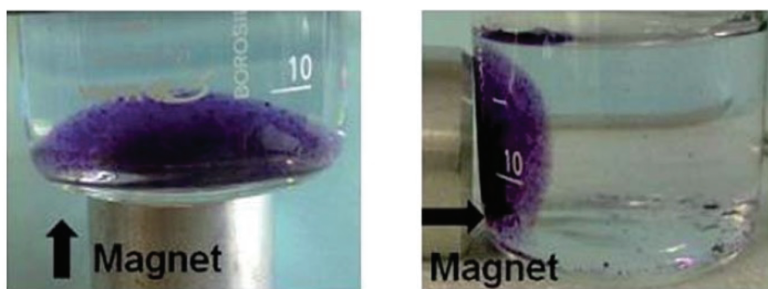


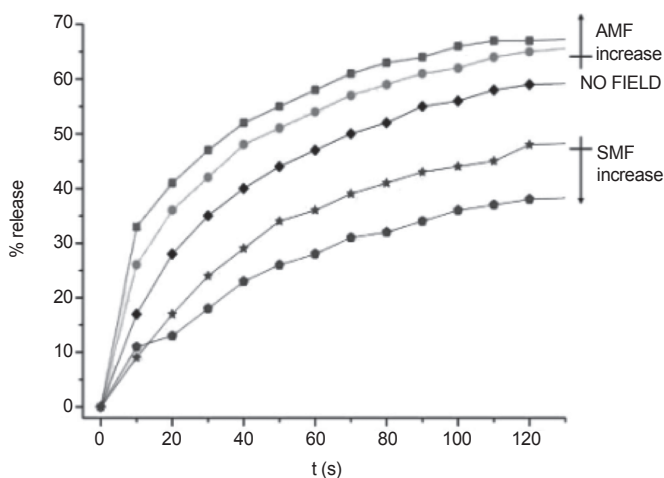
Then the hybrid hydrogel was squeezed through a syringe with the aim of testing its injectability and its capability of keeping the drug inside the hydrogel once injected. [Figure 17](#) shows the hydrogel loaded with toluidine blue after the passage through a syringe in an aqueous solution. It is apparent that the hydrogel is still blue, meaning that the drug is not released when the hydrogel is squeezed through the syringe.

Moreover, a test was carried out to verify the capacity of the hybrid hydrogel to be guided by the use of a magnet capable of producing a magnetic field of 0.4 T, placed outside the beaker. The hydrogel loaded with the drug moves according to the position of the magnet without any release of NPs or dye in the solution. These results show the possible use of the hybrid hydrogel as a drug carrier thanks to its thixotropy, and consequently injectability.

Now the use of an alternating magnetic field (AMF) can be used as a strategy for drug release. As shown in [Fig. 18](#), when AMF (1 mT or 2 mT at 40 kHz) is applied on the system the amount of methylene blue (MB) released from the CMC-MNP is



**Fig. 17.** Images showing the attraction of CMC–NP hydrogels loaded with toluidine blue after being squeezed through a syringe. The magnet is capable to attract the material from the center to the wall of the beaker (Barbucci et al. 2011).



**Fig. 18.** Release of methylene blue from carboxymethylcellulose– $\text{CoFe}_2\text{O}_4$  with the application of static or alternating magnetic field (Uva et al. 2014).