MaGO

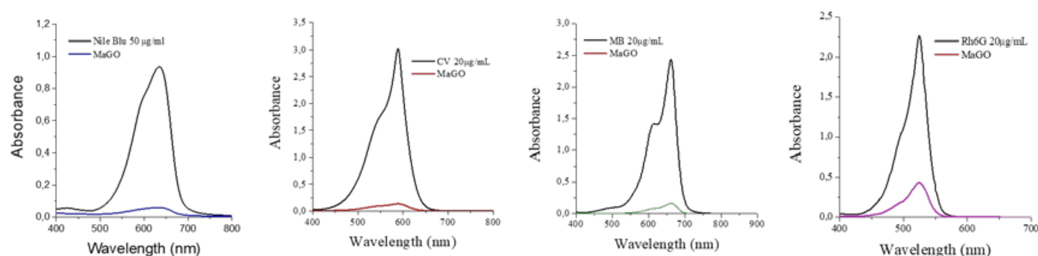
Graphene-doped magnetic beads for separation and purification.

Applications

- **Separation and purification of basic dyes and aromatic molecules**
- **Free dye / dye-antibody selective separation (fast protocol)**

Immagina MaGO™ beads have a magnetic core embedded in an agarose structure. Beads are doped with Graphene Oxide or Reduced Graphene Oxide. Thanks to the particular formulation, the beads can be used ad adsorbent material for different purposes including separation of dyes. To increase the reactive surface and to speed up the analyte flow within the porous structure, MaGO™ beads are composed by hybrid graphene-agarose matrix in the form of micrometer sized beads.

The adsorption capacity of MaGO sample was tested using a set of aromatic positively charged dyes (Nile Blue, Methylene Blue, Rhodamine 6G, and Crystal Violet). All the molecules tested showed a high value of adsorption capacity and a very fast adsorption kinetics.



	Qt (mg/gGO)	t (min)
Nile Blu (NB, H_2O)	989	1
Methylene Blu (MB)	622	1
Rhodamine 6G (Rh6G)	507	1
Crystal Violet (CV)	685	1

Figure 1. Up: UV-visible spectroscopy of the NB, CV, MB, and Rh6G dyes solutions and the supernatants after absorption for 1 minute with MaGO **Table:** Values of absorption capacity calculated on the Graphene content (Qt) and the absorption time of the tested molecules.

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MaGO beads can find application in separation of free dye labels from target protein as reported in Figure 2. In Figure 2A the selective removal of Rhodamine isothyocyanate molecules from a mixture of BSA 488 and the dye was obtained by incubation of the solution with MaGO beads for 15 seconds, followed by magnetic separation of the beads.

As revealed from the Uv-Vis absorption spectra the MaGO beads can efficiently remove unbound dye molecules and can find application in the purification of dye-labelled protein or biomolecules. In Figure 2B the same experiment was carried out with a mixture of BSA-488 and methylene Blue dye, revealing a high efficiency in the separation of the dye from thee solution.

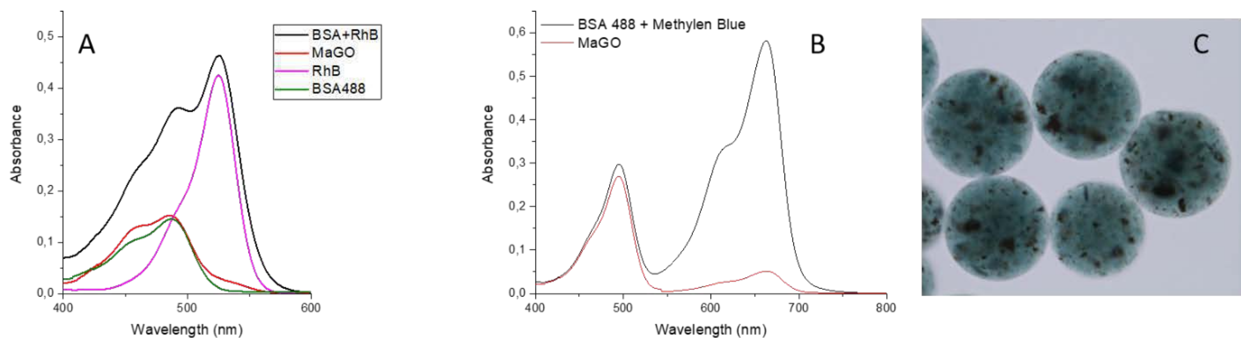

Figure 2. A BSA488 and Rhodamine B isothiocyanate (black line) mixed together and incubated with MaGO^{TM} beads for 15 seconds (red line). The values of BSA488 (green line) and Rhodamine B (magenta line) are reported. **B** BSA488 and Methylene Blue (black line) mixed together and incubated with MaGO^{TM} for 15 seconds (red line). **C.** Optical images of MaGO beads incubated with BSA 488 and Methylene Blue.

TetramethylRhodamine molecules (TAMRA) and TAMRA-labelled antibody (IgG-TAMRA) were incubated with MaGO beads for 5-10 seconds, followed by magnetic separation of the beads. As revealed from the Uv-Vis absorption spectra and spectrofluorometric analysis, MaGO beads can efficiently remove the free dye while the TAMRA-labelled antibody is still in solution (< 10% reduction).

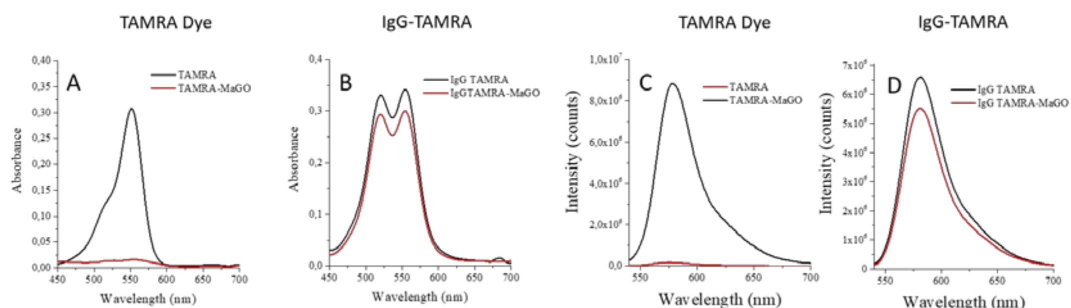

Figure 3. A and B UV Vis of IgG-TAMRA and free TAMRA dye (black lines) incubated with MaGO beads followed by vortexing for 5 seconds (red lines). **C and D.** Fluorescence emission of of IgG-TAMRA and free TAMRA dye (black lines) incubated with MaGO beads followed by vortexing for 5 seconds (red lines).

Protocol

1) Vortex the *MaGO beads* tube for 30 seconds
2) Put the required *MaGO beads* volume in a new 1.5 mL tube
3) Place the tube on the magnet to separate the beads. Remove the supernatant
4) Resuspend the beads in your dye-protein mixture
5) Vortex for 5-10 seconds
6) Place immediately the tube on the magnet to separate the beads. Remove the supernatant enriched with your labelled protein
7) Discard the beads containing the free dye

Composition: graphene-doped magnetic agarose beads
Size: 30-100 µm
Appearance: brown to dark gel
Magnetic properties: superparamagnetic nanoparticles
Amount: 10% v/v gel
Volume: 5 ml
Formulation: Supplied in water 10% EtOH
Storage: Store product at 4-25°C.