Fixing colloidal particles at solid/liquid interfaces using *Moringa oleifera* seed protein as 'glue'

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Colloidal particles such as polymer latices can form large crystalline structures close to, but not directly on a solid/liquid interface by combination of flow, packing constraints and charged repulsion imposed by the solid boundary [1]. These structures can be used directly to modify large areas and as templates for two-dimensional metallic structures using lithography. Such materials are not yet used widely since preserving the required structure on drying remains as a major challenge. Particles tend to move and the structures often crack. Proteins extracted from the seeds of *Moringa oleifera* trees have been shown to be effective flocculants for particles dispersed in water [2] to which they bind strongly. These proteins also adsorb irreversibly to mineral surfaces such as silica and alumina [3, 4]. These features of the proteins allow them to be used as a 'glue' to stick particles in position and to retain their self-organized structure. We present neutron reflectivity and off-specular scattering measurements as well as atomic force microscopy images from colloidal particles in the presence and absence of *Moringa* protein. *Moringa* protein has been shown to bind polystyrene latex and silica particles successfully at a surface, even after extensive rinsing with water and anionic surfactant, $C_{16}TAB$.

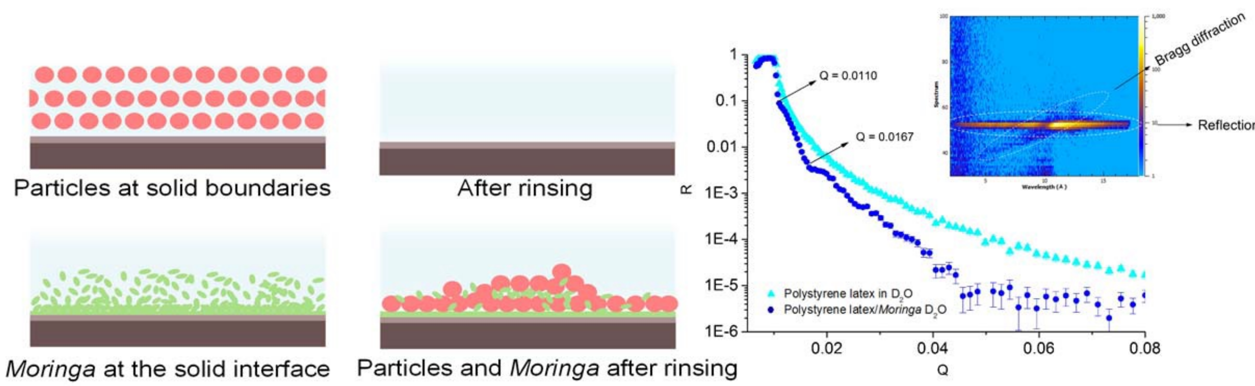

Figure 1. Schematic picture of the structure of particles at solid/liquid interface before and after rinsing are shown on the left with reflectivity data showing the layering of particles in the presence (dark blue circles) and absence of *Moringa* oleifera proteins (light blue triangles).

References

1. M. S. Hellsing et al. *Appl. Phys. Lett.* (2012) **100**, 221601.
2. H. M. Kwaambwa, A. R. Rennie *Biopolymers* (2011), **97**, 209
3. H. M. Kwaambwa et al. *Langmuir (*2010) **26**, 3902
4. M. S. Hellsing et al. *Colloids and Surfaces A: Physicochem. Eng. Aspects* **460,** (2014), 460