Geophysical Research Abstracts
Vol. 18, EGU2016-6099, 2016
EGU General Assembly 2016

Effect of lipid/polysaccharide ratio on surface activity of model root mucilage in its solid and liquid states

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The rhizosphere can be defined as the volume of soil around living roots, which is influenced by root activity. The biological, chemical and physical conditions that prevail in the rhizosphere are significantly different from those of the bulk soil. Plant roots can release diverse organic materials in the rhizosphere which may have different effects on its bio-chemo-physical activity. Among these exudates is the root mucilage which can play a role on the maintenance of root–soil contact, lubrication of the root tip, protection of roots from desiccation and disease, stabilization of soil micro-aggregates and the selective absorption and storage of ions. The surface activity of the root mucilage at the liquid-air interface deduced from its surface tension depression relative to water, implying on its amphiphilic nature. Consequently as the rhizosphere dry out, hydrophobic functional groups may exhibit orientation at the solid-air interface and thus, the wettability of the rhizosphere may temporarily decrease. The major fraction of the root mucilage comprise of polysaccharides and to a much lesser extent, amino acids, organic acids, and phospholipids. The most frequent polysaccharide and phospholipids detected in root mucilage are poly-galacturonic acid (PGA) and Phosphatidylcholine (PC), respectively. The latter, is thought to be main cause for the surface active nature of root mucilage. Nevertheless, the role and function of root mucilage in the rhizosphere is commonly studied based on model root mucilage that comprise of only one component, where the most frequent ones are PGA or PC (or lecithin). The main objective of this study was to quantify the effect of concentration and PGA/PC ratios on the wettability of a model rhizosphere soil and the surface tension of the model root mucilage at the liquid-air interface. The PGA/PC mixtures were measured for their equilibrium and dynamic surface tension using the Wilhelmy-Plate method. Quartz sand or glass slides were coated with PGA and/or PC using the above solutions and measured for their initial advancing contact angle and dynamic one, using the capillary rise and sessile drop methods, respectively. The results of this study will be presented and their implications for the wettability of the rhizosphere will be discussed.