

Figure 1: Visualization of the surface chemistry of the grafted and native membranes. “Native” denotes a unmodified TiO₂ NF membrane; “MPA” a methyl grafted membrane using the phosphonic acid grafting technique; “PGR/MGR/PrGR” a phenyl/methyl/propyl grafted membrane using the Grignard grafting technique; “PolyA” a polyamide NF membrane. Important to note, in case of MPA, only the bidentate bonding mode is presented as an example, but different bonding modes are possible (Mustafa et al., 2014; Randon et al., 1995; Mutin and Guerrero 2005).

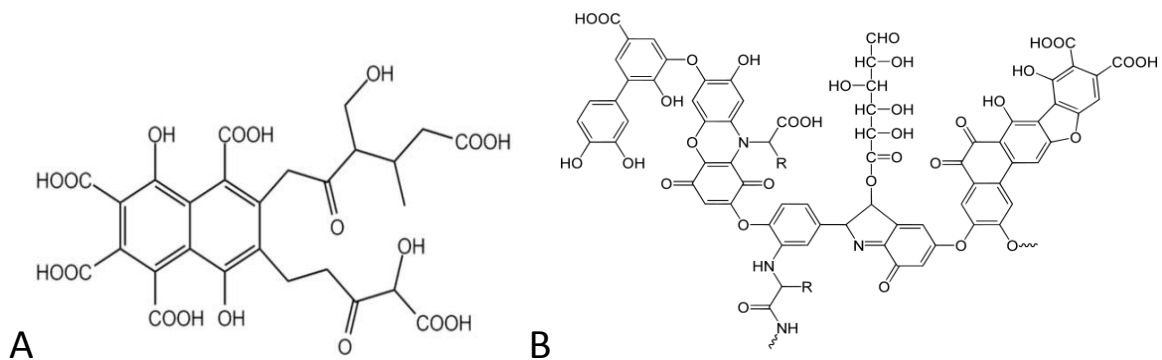


Figure 2: FAs and HAs are a mixture of many molecules. A) shows an example of a typical FAs structure (molecular weight is up to 5 kDa) (Buffle et al., 1977) and B) an example of a typical HAs structure (molecular weight is up to 50 kDa) (Stevenson, 1994).

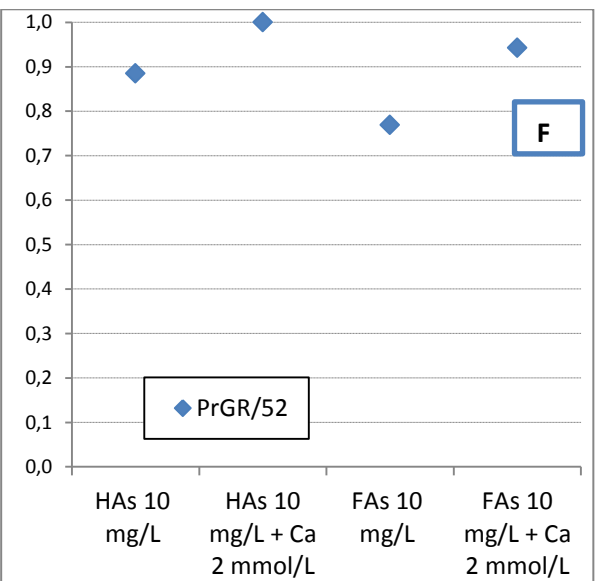
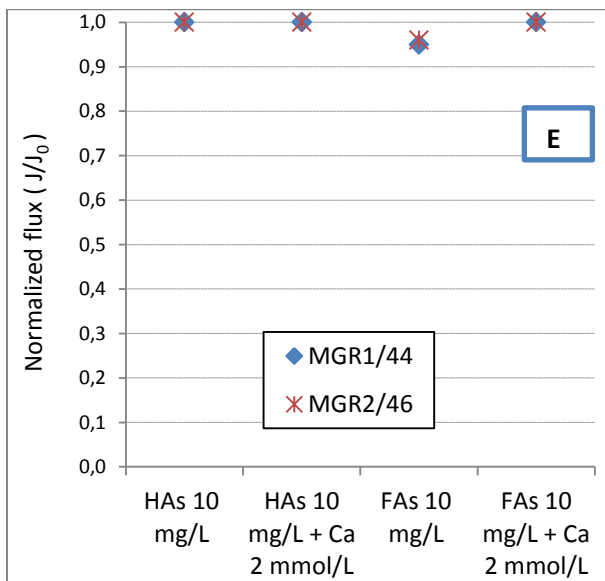
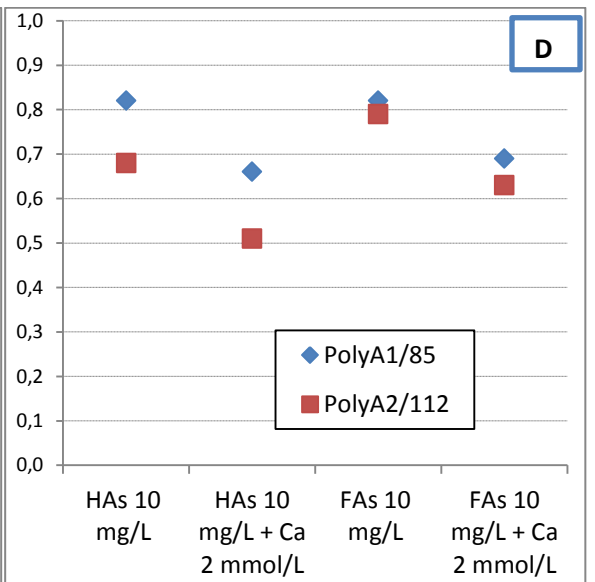
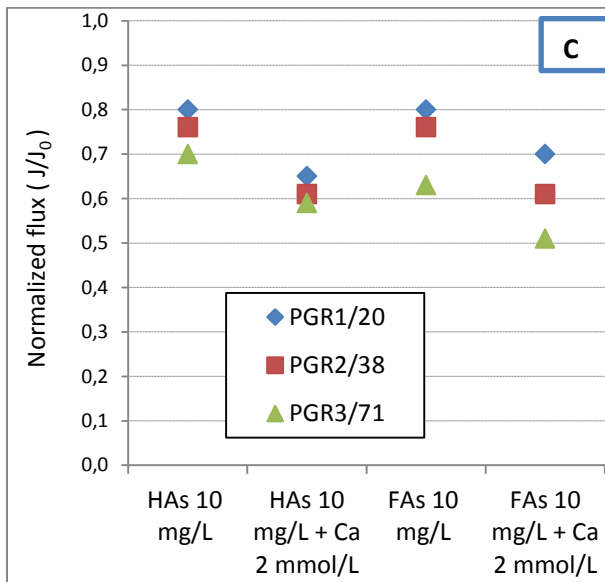
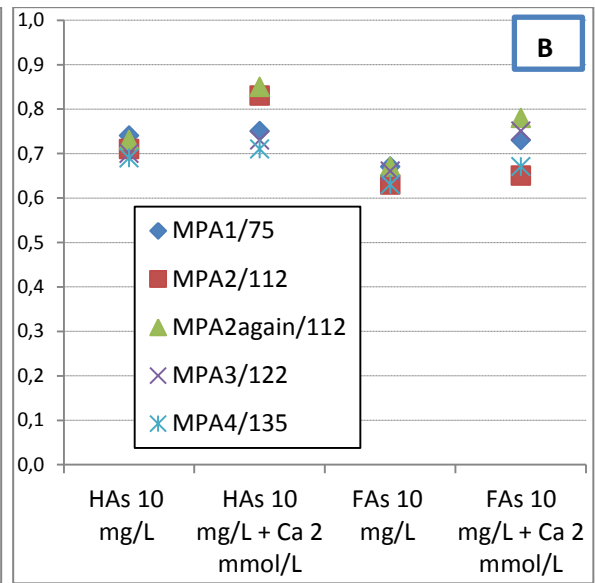
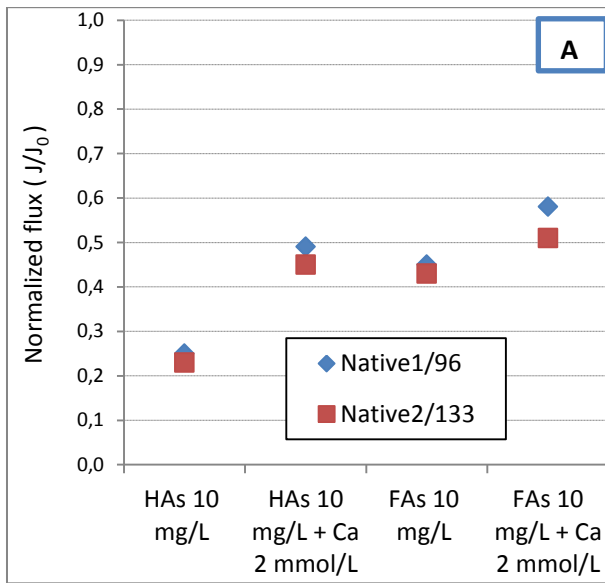
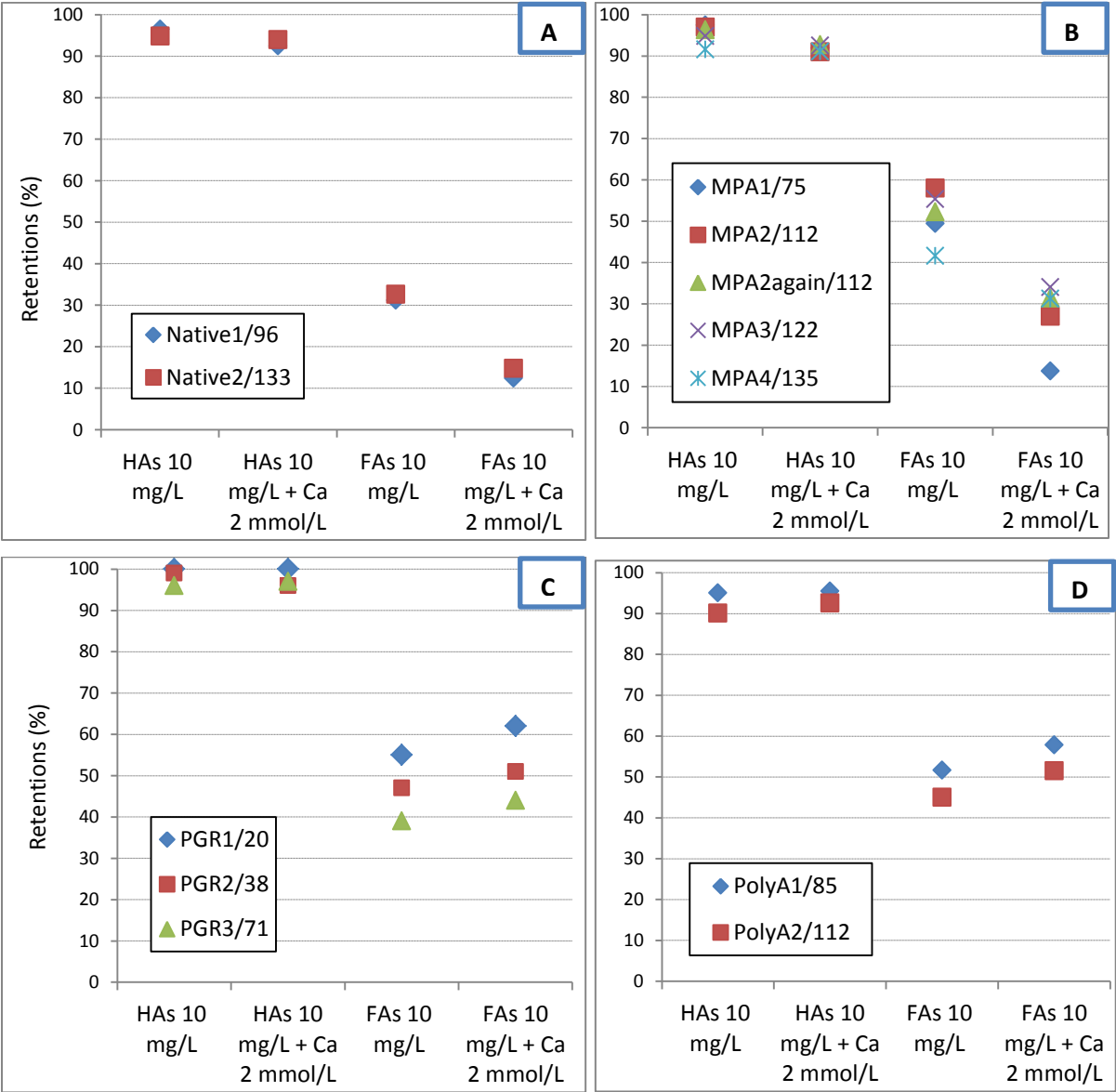


Figure 3: Normalized flux decline caused by HAs and FAs with and without Ca²⁺, measured for A) native ceramic membranes, B) MPA membranes, C) PGR membranes, D) PolyA membranes, E) MGR membranes, and F) PrGR membranes. The membranes were cleaned in between all measurements. The number indicated behind “/” represents the pure water flux J₀ of the membranes (measured at 25°C, 5 bar and 2 m/s)



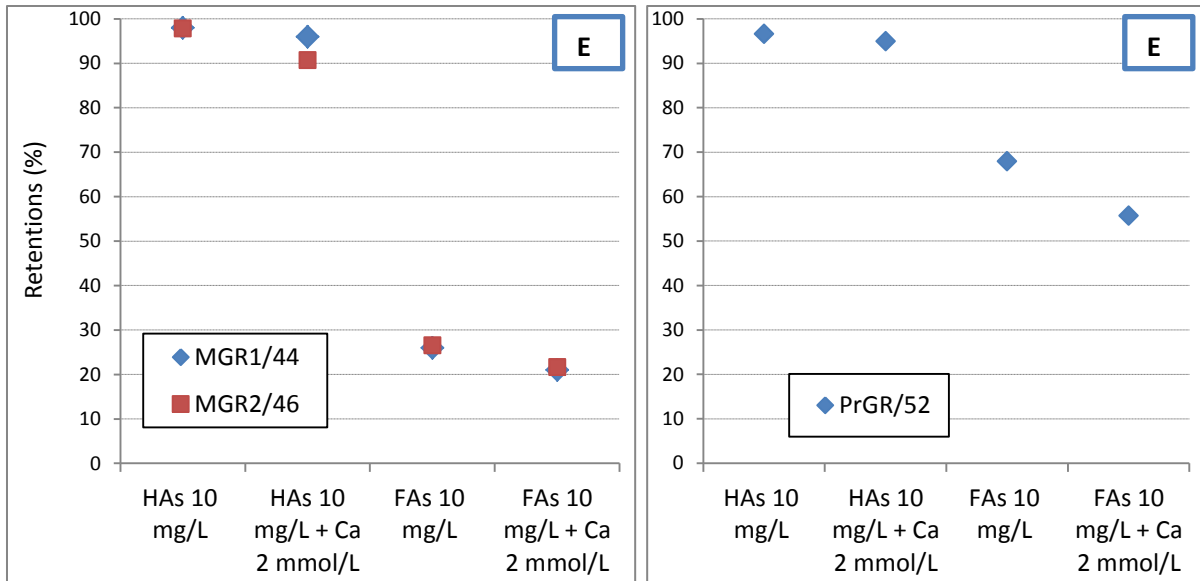


Figure 4: Retentions of HAs and FAs (in %), with and without Ca^{2+} , during the fouling measurements using the following membranes A) native ceramic membranes, B) MPA membranes, C) PGR membranes, D) PolyA membranes, E) MGR membranes, and F) PrGR membranes. The membranes were cleaned in between all measurements. The number indicated behind “/” represents the pure water flux J_0 of the membranes (measured at 25°C, 5 bar and 2 m/s).

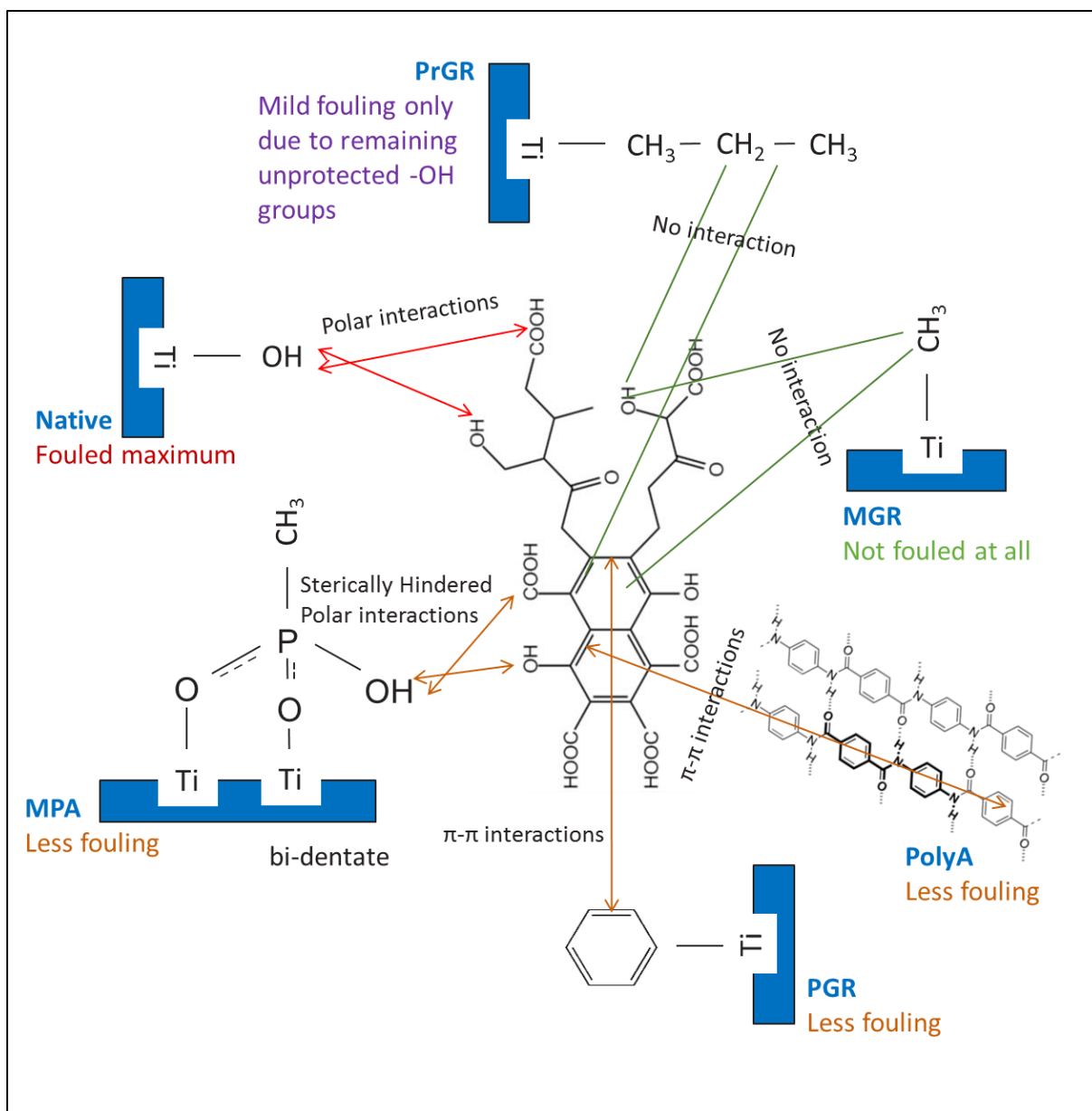


Figure 5: Schematic representation of the possible interactions between a FAs molecule and all investigated membrane types (adopted from Mustafa et al., 2014).

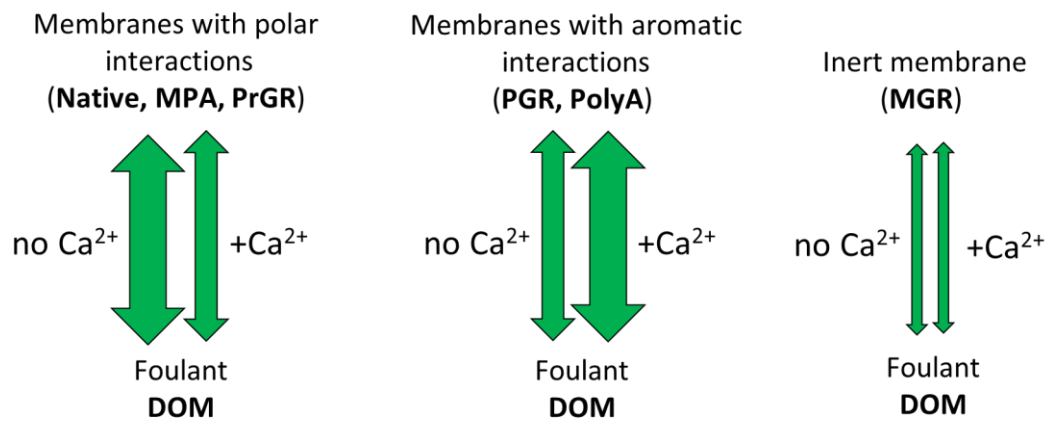


Figure 6: Schematic representations of the changes in membrane-foulant interactions with and without Ca²⁺. The thickness of the arrows represents the amount/strength of possible interactions.