Time-resolved fluorescence and fluorescence quenching in model food emulsion stabilized by β-lactoglobulin

Claude Genot, Xiaochen Han, Michèle Dalgarrondo

INRA UR 1268 BIA, Nantes, France

Many foods can be seen as oil-in-water emulsions in which lipids are in the form of oil droplets stabilized by proteins and other emulsifiers adsorbed at the oil-water interfaces (Genot, Kabri, & Meynier, 2013). In these systems the proteins partition between the interface and the aqueous phase, participating to the stabilization of the system. Steady-state fluorescence spectroscopy was shown to give information on structural changes due to protein adsorption and chemical modifications linked to oxidative phenomena (Casterlain & Genot, 1994; Rampon, Lethuaut, Mouhous-Riou, & Genot, 2001). In the present work, we tested time-resolved fluorescence spectroscopy directly applied to model emulsion to study modifications of proteins when used as emulsifier and adsorbed at oil-water interfaces.

The model consisted in rapeseed oil stabilized by β–lactoglobulin (BLG) (Berton, Ropers, Guibert, Solé, & Genot, 2012). The decay of Trp time-resolved fluorescence was slower for adsorbed proteins than for proteins in the aqueous phase. The best fit for the decay was found with two lifetimes. The contribution of the longest lifetime was greatly enhanced in adsorbed protein, as well as mean lifetime, indicating different protein sub-structure populations and Trp environments depending on protein location. Stern-Volmer plots calculated from both steady-state and time-resolved data of fluorescence quenching by acrylamide indicated that both dynamic and static quenching occurred in the emulsion and in the non-adsorbed protein while mainly static quenching would take place in the adsorbed one. Lower quenching constants were noticed in the emulsion than in the BLG solution and in adsorbed protein than to protein in the aqueous phase indicating a decrease of ligand binding capacity of the emulsified and adsorbed protein.

These results demonstrate that time-resolved fluorescence can be used directly on complex systems such as emulsions to investigate molecular phenomena. They also evidenced differences in the interaction potential of adsorbed and non-adsorbed β-lactoglobulin.

Keywords: Emulsion, protein, interface, time-resolved fluorescence