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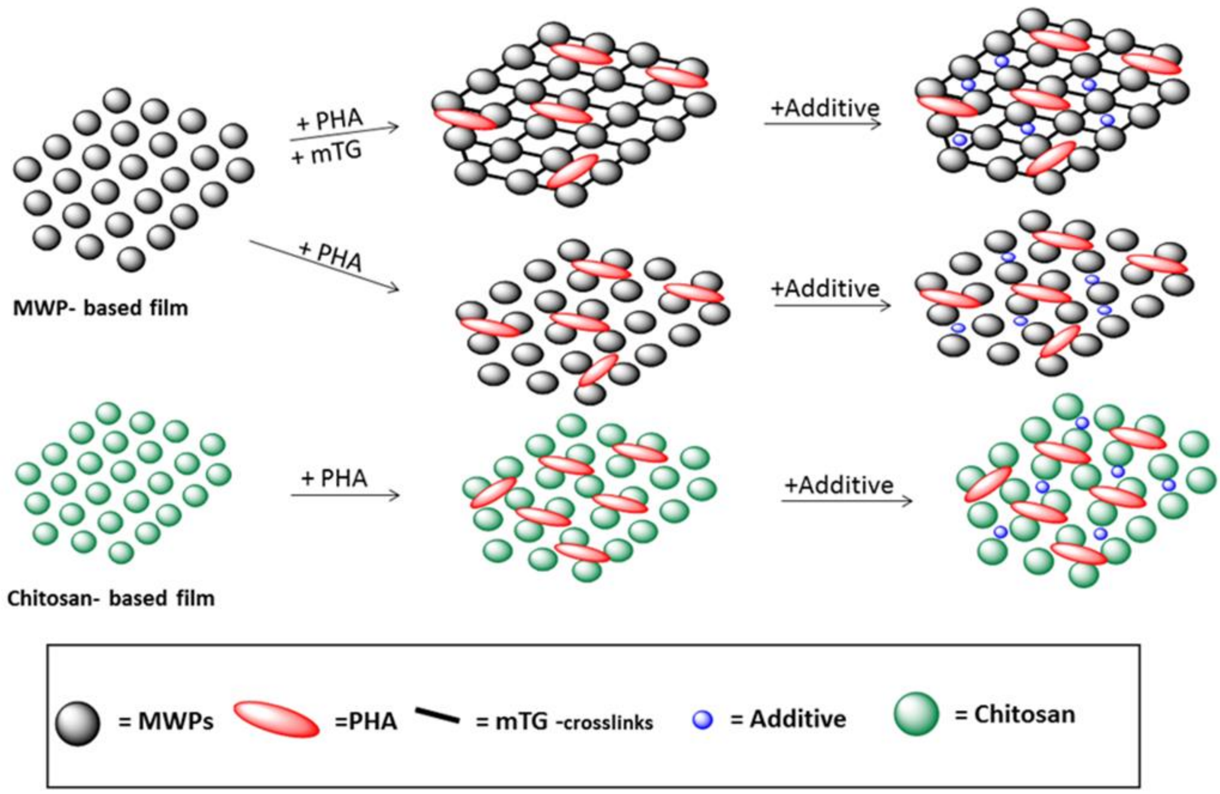
TITLE: **New biomaterials obtained by grafting polysaccharide/protein-based films with polyhydroxyalkanoates**

The dairy industry gives rise to considerable quantities of wastewaters. Dairy waters are generally free of toxic agents. Nevertheless, because of the high organic contents and high salinity, these waters cannot be discharged directly and should be treated before wasting, resulting in additional costs for the manufacturing companies.
Thanks to innovative downstream and biotechnological processes, milk whey (MW), the main liquid by-product of cheese and curd manufacturing, rather than a waste product might be considered a resource to obtain high added value products,Circular Economy (CE) (https://www.ellenmacarthurfoundation.org).
On the other hand, chitin is the second most abundant polysaccharide existing in nature and it is found in the exoskeleton of crustaceans, in fungal cell walls and in other biological materials (Leceta et al., 2013). It is mainly poly(β-(1–4)-2-acetamido-d-glucose), which is structurally identical to cellulose except that a secondary hydroxyl on the second carbon atom of the hexose repeat unit is replaced by an acetamide group. Chitin is easily converted in a water-soluble deacetylated (to varying degrees) form called chitosan. Actually, chitosan, a copolymer consisting of β-(1–4)-2-acetamido-d-glucose and β-(1–4)-2-amino-D-glucose units, has non-toxic and biodegradable characteristics, which are of great interest for packaging purposes.



One possibility to use MW and chitosan, is their conversion into **bioplastics,** an attractive eco-friendly alternative to petroleum-based plastics since they can be easily degraded by the enzymes present in different microorganisms. The main biopolymers used so far to prepare these innovative biomaterials are some aliphatic polyesters, e.g. polylactic acid and polyhydroxyalkanoates (PHAs), various proteins and numerous polysaccharides obtained from plant or animal feedstocks. However, different bioplastics are prepared for different applications. For example, edible coatings are produced to improve food quality and can be consumed together with the packaged products (Giosafatto *et al*. 2014; Porta *et al*., 2011; 2015; Esposito et al., 2016). PHAs have attracted research and commercial interests worldwide because they can be used as biodegradable thermoplastics and because they can be produced from renewable resources, therefore they possess sustainability and environment-friendly properties.

Therefore the general objective of the present project is to valorize the dairy waste MW and chitin waste by obtaining new polyhydroxyalkanoates-(PHAs) blended biomaterials for food coating and/or packaging.

In particular, we propose the use of milk whey proteins (MWPs) (that represent about 20% of milk proteins), chitosan or PHAs to produce edible films and coatings that can be used to extend the shelf-life of different foods (Rossi Marquez et al., 2013; 2017). In particular MWPs will be modified or not by microbial transglutaminase (mTG), a calcium independent enzyme that catalyzes the introduction of ε-(γ-glutamyl)-lysine crosslinks into proteins via an acyl transfer reaction. Several food proteins act as acyl donors and/or acceptors for mTG and, among the milk proteins, both caseins and MW α-lactalbumin and β-lactoglobulin are excellent acyl donor and/or acceptor substrates for the enzyme (Mahmoud & Savello,1992; Sharma et al., 2001; Wilcox & Swaisgood, 2002).

The derived materials obtained will be characterized according to different technological features (mechanical and gas barrier properties, morphological characterization, digestibility studies) that might allow them to be applied in the industrial sector as either food coating or wrapping.

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