EC NUTRITION EDITOR'S COLUMN - 2016

The Potential of Whey Protein in Food Packaging

Ana Sanches–Silva*
National Institute of Health Dr Ricardo Jorge,
Lisbon,
Portugal

Mariana Andrade[1,2], Regiane Ribeiro-Santos[1,3], Nathália Ramos de Melo[3,4] and Ana Sanches–Silva[1,5]*

[1]Department of Food and Nutrition, National Institute of Health Dr. Ricardo Jorge, I.P., Lisbon, Portugal
[2]Faculty of Sciences, University of Lisbon, Campo Grande, 1749-016, Lisbon, Portugal
[3]Department of Food Technology, Institute of Technology, Federal Rural University of Rio de Janeiro, Seropédica, Brazil
[4]Department of Agribusiness Engineering Federal Fluminense University- Volta Redonda, RJ -Brazil
[5]National Institute of Health Dr Ricardo Jorge, Lisbon,Portugal

COLUMN ARTICLE

Conventional packaging was created to protect foods from environmental factors, such as microorganisms, light, oxygen, among others. It was also created to facilitate food handling and to preserve the nutritional value and organoleptic characteristics of foods as well as to convey food information. Most of these packages are made from non-renewable resources and/or non-biodegradable materials, representing a very serious environmental problem, by causing food and material waste [1,2]. In this line of thought, new materials have emerged to address these problems.

Whey protein is one of those materials and it can be used to produce edible and biodegradable food packaging besides being applied directly to food (e.g. as fat replacer). Whey is a secondary product of cheese production, considered, for many years, food waste and an environmental pollutant due to the lack of treatment of the disposal of dairy industries. Whey is composed mainly by water (93%), lactose (4.5 - 5% w/v), soluble proteins (0.6 - 0.8% w/v) and lipids (0.4 - 0.5% w/v) [3,4]. Whey protein can be presented in three forms: whey protein concentrate (WPC) (Figure 1), whey protein isolate (WPI) and whey protein hydrolysate (WPH). The concentrated form presents the highest lactose content and the lowest protein content which can differ between 25% and 89%. The isolated form presents the highest protein percentage (90 to 95%) and the hydrolysed form presents the lowest concentration of lactose [5]. Any form of whey protein can be applied to food packaging, in particular, active food packaging, due to their biological and functional properties such as good digestibility, gelling and emulsifying properties, and has a great solubility in water [3,6,7].

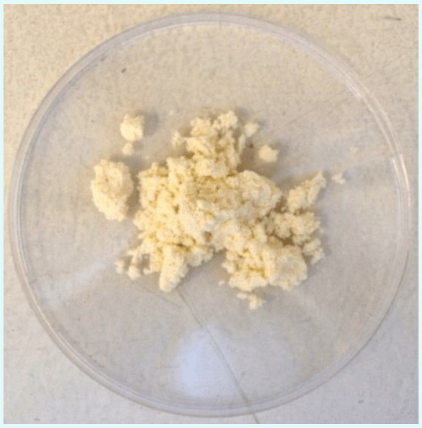

Figure 1: Whey protein concentrate.

Citation: Ana Sanches-Silva., et al. "The Potential of Whey Protein in Food Packaging". EC Nutrition ECO.01 (2016): 25-26.

One of the limitations of whey protein as matrix for food packaging is its hydrophilic nature. Due to this fact, films are highly permeable to water which will limit their use to foods with a low moisture content [8].

Essential oils (EOs) are secondary metabolites from aromatic plants and are known to have antioxidant and antimicrobial activities. In the study developed by Seydim and Sarikus (2006), EOs from oregano, rosemary and garlic were incorporated in WPI films and their antimicrobial activity was tested against *Escherichia coli, Staphylococcus aureus, Salmonella enteritidis, Listeria monocytogenes and Lactobacillus plantarum*. The authors succeeded in the incorporation of the three essential oils in WPI films. Also, the film incorporated with oregano and the film incorporated with garlic EOs exhibited a larger inhibition zone that the one showed by the film with the rosemary EO [9]. Javanmard (2008) studied the incorporation of olive oil in a WPC film to inhibit the peroxide formation in dried peanut kernels during a period of 4 weeks. The author concluded that the WPC films incorporated with olive oil prevented the formation of peroxides when compared to the control sample [10]. Zinoviadou, Koutsoumanis and Biliaderis (2009) also tested a WPI film incorporated with different oregano EO percentages. In this study, the impact of the EO incorporation on the mechanical and physical properties of the WPI films was tested and the EO action against beef spoilage flora was also evaluated. The WPI film is an effective carrier of oregano EO and can sustain its structural integrity. Also, the film incorporated with the EO was also effective in the inhibition of the beef's spoilage flora [11].

Whey protein has great potential to produce biodegradable and edible packaging. A broader spectrum of properties, namely antioxidant and antimicrobial, can be achieved through the incorporation of substances, such as essential oils, intended to be released during food storage, as an active system.

BIBLIOGRAPHY

1. Dainelli D., *et al*. "Active and intelligent food packaging: legal aspects and safety concerns". *Trends in Food Science and Technology* 19.1 (2008): S103-S112.
2. Thøgersen J. "Wasteful food consumption: Trends in food and packaging waste". *Scandinavian Journal of Management* 12.3 (1996): 291-304.
3. Ramos OL., *et al*. "Physical effects upon whey protein aggregation for nano-coating production". *Food Research International* 66 (2014): 344-355.
4. Singh R Geetanjali. "Whey proteins and its value-added applications". In: Dillon EG, editor. Protein Byproducts: Transformation from environmental burden into value-added products. First Edit. Academic Press (2016).
5. Marshall K. "Therapeutic applications of whey protein". *Alternative medicine review: A Journal of Clinical Therapeutic* 9.2 (2004): 136-156.
6. Sanches-Silva A., *et al*. "Trends in the use of natural antioxidants in active food packaging: a review". *Food Additives and Contaminants Part A Chemistry Analysis Control Exposure & Risk Assessment* 31.3 (2014): 374-395.
7. Khanzadi M., *et al*. "Physical and mechanical properties in biodegradable films of whey protein concentrate-pullulan by application of beeswax". *Carbohydrate Polymers* 118 (2015): 24-29.
8. Han J. "Innovations in Food Packaging. 2nd Edition". *Academic Press* (2013).
9. Seydim AC and Sarikus G. "Antimicrobial activity of whey protein based edible films incorporated with oregano, rosemary and garlic essential oils". *Food Research International* 39.5 (2006): 639-644.
10. Javanmard M. "Effect of whey protein edible film packaging on the quality and moisture uptake of dried peanuts". *Journal of Food Process Engineering* 31.4 (2008): 503-516.
11. Zinoviadou KG., *et al*. "Physico-chemical properties of whey protein isolate films containing oregano oil and their antimicrobial action against spoilage flora of fresh beef". *Meat Science* 82.3 (2009): 338-345.