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Development of active edible coatings for the preservation of *Agaricus bisporus* mushrooms

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Mushrooms are highly perishable food products that tend to lose their unique organoleptic properties immediately after harvesting. Their short shelf-life is mainly explained by the high losses of water vapour that favour dehydration, high respiration and microbial colonization by bacteria or fungi. Furthermore, enzymatic activity and biochemical alteration lead to mushrooms quality losses [1]. The microorganisms most often associated with mushroom spoilage and colonization are gram-negative bacteria especially those belonging to Pseudomonae family such as *Pseudomonas fluorescens* [2].

Active edible coatings have been increasingly applied in the last years as an alternative method for the control of microbial contamination in food products. The incorporation of antimicrobial compounds has potential for increasing food quality and safety thus extending its shelf-life [3-4]. Recently, several studies have been developed on the incorporation of natural antimicrobial compounds in edible coatings, responding to an increasing demand by the consumers for foods without chemical additives. Some of the natural antimicrobials are essential oils, such as carvacrol and eugenol, which were shown to possess antimicrobial activity against *P. fluorescens* and *E. coli* [5].

Aiming at developing an active edible coating to increase the shelf-life of *Agaricus bisporus* mushrooms polysaccharide-based coatings were developed using chitosan and alginate, glycerol (as plasticizer) and Tween 80 (as surfactant). Coating formulations were evaluated through a 2^2 factorial experimental setup with one central point where the influence of the added compounds on W_s (spreading coefficient - wettability) was determined (Pareto charts analyses, $p<0.05$). W_s was evaluated on the pileus of the mushroom once this is the main part of the mushroom and is a indicator of quality and freshness [6]. Tween 80 and polysaccharide concentrations showed to influence the values of W_s. The optimal coating formulation to be applied was selected through the determination of the coating that presents the minor value of W_s (i.e. value close to zero) and need less quantity of ingredients (i.e. more economic coating). Based on this, two coatings were selected, one containing 0.5% (w/v) of chitosan, 0.125% (v/v) of glycerol and 0.15% (v/v) of Tween 80 and other with 0.5% (w/v) of alginate, 0.125% (v/v) of glycerol and 0.05% (v/v) of Tween 80, presenting W_s values of -62.4 and -49.9 mN/m, respectively.

Different concentrations (0-1% v/v) of eugenol and carvacrol and a combination of both (1:1 – v/v) were incorporated in chitosan and alginate coatings and their antimicrobial activity was evaluated through CLSI M7-A7 [7]. In the case of *E. coli*, the chitosan-based coatings containing eugenol showed higher antimicrobial activity than the ones containing carvacrol, being this activity clear after 48 h of incubation. The same behaviour was observed for alginate-based coatings containing eugenol and carvacrol. Results with *P. fluorescens* were similar to those obtained for *E. coli*, being the only difference registered for the results of inhibition at 24 and 48 h of incubation, where the values of inhibition were similar for both times of incubation. There was a clearly the larger microbial inhibition against *P. fluorescens* in comparison to *E. coli,* for both coatings - in the presence of eugenol and carvacrol.

These results suggest that active polysaccharide-based coatings may present a valuable solution for food packaging in order to prevent microbiological spoilage of *Agaricus bisporus* mushrooms by *P. fluorescens* and *E. coli*. Further studies will be addressed evaluating the effect of developed coatings on shelf-life parameters of *Agaricus bisporus* mushrooms during storage.

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Abstracts

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