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Sous vide cook-chill mussel (*Mytilus galloprovincialis*): Evaluation of chemical, microbiological and sensory quality during chilled storage (3 Â°C)

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1. Introduction

Due to socio-economic evolution and lifestyle, a growing number of single-person and small households (Byrne, 1998) have boosted the demand for convenience in meal preparation (Calderon, Iglesias, Laca, Herrero, & Diaz, 2010). Thermal processing is still one of the most common methods used to obtain safe convenience food with an extended shelf-life. Designing thermal processes for such products, typically in the range of 60-95°C for 10 to 30 min, is challenging since the heat treatments required for inactivating target microorganisms may cause undesirable quality changes in lipid and protein fractions. In seafood products, quality is severely reduced when the thermal process is designed for a shelf-life of more than 21 days under chilled conditions (Rosnes, Skåra, & Skipnes, 2011). New methods focusing on rapid or minimal heating able to maintain safety levels, are therefore fundamental for the future development of processed seafood. Recently, technological developments and new packaging materials have led to innovative food preservation strategies such as *sous vide* cook-chill (SVCC) processing.

SVCC processing consists of placing fresh, raw products in a vacuum-sealed bag or a semi-rigid tray, cooking it slowly under mild heating conditions i.e. pasteurization, immediate cooling and maintaining refrigeration at 3±1°C until serving. SVCC offers many advantages over traditional food processing such as the hermetic seal, which prevents moisture loss and contamination during and after treatments. In addition, the mild cooking temperature preserves the original flavor, texture and nutritional qualities. Moreover, vacuum packaging increases product shelf-life by inhibiting aerobic spoilage microrganisms, oxidative and other chemical spoilers (Ghazala, Ramaswamy, Smith, & Simpson, 1995) and is now widely used in food service establishments (catering, restaurant), fast food trades and supermarkets.

Despite the growing demand for and interest in safety of ready-to eat seafood, fast to prepare and easy to store seafood (Kennedy, Wall, Storrs, Devoluy, & Cruveiller, 2007), only a few studies are available regarding the application of *sous vide* cook-chilled processing to seafood (Diaz, Nieto, Banon, & Garrido, 2009; Espinosa, Diaz, Linares, Teruel & Garrido, 2015; Garcia-Linares, Gonzalez-Fandos, Garcia-Fernandez, & Garcia-Arias, 2004; Ghazala et al., 1995; Gonzalez-Fandos, Villarino-Rodrıguez, Garcıa-Linares, Garcıa-Arias, & Garcıa-Fernandez, 2005; Gonzalez-Fandos, Garcıa-Linares, Villarino-Rodrıguez, Garcıa-Arias, & Garcıa-Fernandez, 2004; Shakila, Jeyasekaran, Vijayakumar, & Sukumar, 2009). Moreover, such technology has not been applied to shellfish yet. While mussels have been subjected to chilled storage (Erkan, 2005; Gökoğlu, 2002), modified atmosphere packaging (Goulas, Nessi, Kontominas, & Savaidis, 2005a; Pastoriza, & Bernardez, 2011), freezing (Gökoğlu, Erkan, & Özden, 2000), cooking and vacuum cooling (Cavalheiro, Schmidt, Rodrigues, Siga, Leitempergher & Laurindo, 2013; De Lima, Siga, Leitempergher, Lerin, Soares, Tosati, Rodrigues & Monteiro, 2017), smoking (Turan, Sönmez, Çelik, & Kaya, 2008) and canning (Şengör, Gün, & Kalatofatoğlu, 2004) *sous vide* cook-chill processing has never been considered.

Bivalve mollusk, as filter feeders, can accumulate microorganisms, including pathogens, from seawater and the number and type of microorganisms present in the water depend on several seasonal, climatic and anthropogenic factors (Šolìć, Krstulović, Jozić, & Curać, 1999). Even if their harvesting and