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ReviewArticle

ADVANTAGES AND LIMITATIONS OF *SOUSVIDE* PROCESSING OF VEGETABLES

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Abstract: While the sousvide processing has been majorly focused on the shelf life extension of meat products and for this few reviews are also available (Creed, 1995; Schellekens 1996; Baldwin, 2012), however there is no review on the sousvide processed vegetables and the changes which incurs during the processing and storage following sousvide processing. Hence the present study discusses the efficacy of sousvide processing with respect to the changes in the bioactive compounds of vegetables following sousvide processing.
Keywords: *Sousvide* processing, vegetables, vacuum packaging, bioactive compounds.

Introduction

Vegetables are a perishable food material and, inspite of taking all precautions for post harvest handling, it is impossible to keep all available food in its farm-fresh state thus to make them available for later use they are often processed. The major emphasis of food processing is preservation or shelf-life extension by preventing undesirable changes in the wholesomeness, nutritive value and sensory qualities. Though processing extends the shelf life of vegetables it affects the stability of bioactive compounds such as polyphenols, carotenoids, vitamins etc (Soria et al., 2010). Consumer demands for a quality product with fresh like characteristics, has led to the development of minimal processing techniques (Ohlsson, 1994). Minimally processed vegetables may be defined as those subjected to some processing techniques of lesser magnitude than boiling, canning or freezing, but which nevertheless add value to the product before distribution and consumption (Martin-Diana et al., 2006). However minimal processing alone has its own limitations. A significant decrease in the levels of α, β and total carotene following shredding of raw carrots was reported by Sant'Ana et al. (1998). This was attributed to exposure of their cut surface to oxygen and light leading to their degradation. Furthermore Ruiz-Cruz et al. (2007) also reported the losses of α, and β-carotene following minimal processing (shredding) and followed by storage. This was attributed to oxidation induced by lipoxygenase-associated free radicals

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(Klein et al., 1985) and increased exposure of carotenoids to oxygen resulting from exposure to light and oxygen during the processing of carrots.

Improvement in minimally processed food has led to research in development of processing technologies intermediate to minimal processing and conventional thermal processing. One such technology is *sous-vide* processing.

Sous-vide processing is aimed at producing products with more fresh like properties and involves heating in vacuum sealed pouches to end point temperature of 90^{o}C resulting in shelf-life of 21 days at 4^{o}C. *Sous-vide* or vacuum-cooked foods are defined as ''raw materials or raw materials with intermediate food, that are cooked under controlled conditions of temperature and time inside heat-stable vacuumized pouches'' (Schellekens and Martens, 1992). SV products are typically heated at relatively mild temperatures (65-95°C) for a long period of time. After heating the products are quickly cooled and kept in chilled storage (1-4°C) for up to 21 days.

Affect on bioactive compounds

Patras and other (2009) reported that there was only 4% loss of carotenoids following SV processing and higher retention of carotenoids in SV processed carrots than those subjected to water immersion processing, they also reported retention of higher levels of carotenoids following chill storage. However Werlein (1998) reported no changes in the levels of α and β-carotene following SV processing compared to raw samples of carrot, though a slight decrease in their levels was noted after 7 days of storage, during the storage period of 21 days. The degradation of carotenoids was attributed to their highly unsaturated chemical structure which has an extensive conjugated double-bond system causing them to be very susceptible to oxidation, isomerization or other thermal-triggered chemical reactions during processing (Sánchez-Moreno et al., 2006). Rawson et al. (2010) reported that losses in polyacetelenes were higher in parsnips processed by SV compared to water immersion cooking. However they further reported that following storage, SV processed samples resulted in a significant decrease in falcarinol levels however no change in falcarindiol levels was observed. Falcarinol levels in water immersion processed samples were significantly higher than in SV samples, falcarindiol was particularly susceptible to aerobic storage following water immersion processing with losses of up to 70% occurring after 5 days storage. Moreover the shelf life of water immersion processed parsnip samples were only limited to 5 days. Hence compared to water immersion processing and storage, SV processed parsnips samples had a longer shelf life of 21 days and the bioactive polyacetylenes retained.

Renna et al. (2014) reported that the sousvide processing did not significantly affect the quality parameters of chicory compared to their raw counterparts. Moreover the *sous vide* product always showed the highest score for sensory evaluation among the cooking methods (ie. Boiling, steaming, microwave cooking and sousvide processing). Furthermore Renna et al. (2014) confirmed that sousvide processing did not affect total phenol content and antioxidant activity compared with uncooked stems of Chicory.

Conclusion

Hence it can be concluded that *sousvide* processing has a great potential in retaining the bioactive components in vegetables. Moreover the fact that in *sousvide* processing the samples are vacuum packed, leads to higher retentions of colour and flavor components in vegetables. Souvide processing has a good scope to be used in food industries in place of normal conventional thermal processed vegetables. Further research in terms of pretreatments needed for individual vegetables need to be further researched.

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