Evaluation of ozone treatment in vacuum for in-shell Brazil nuts shipment and aflatoxins

Scussel, V.M.*#[1], Giordano, B.N.E.[1], Simao, V.[1], Manfio, D.[1], Galvao, S.[1], Scussel, J.N.[2]
[1] Food Science & Technology Department, Center of Agricultural Sciences, Federal University of Santa Catarina, P.O.Box 476, Florianopolis, SC, CEP 88034-001, Brazil. Email: vildescussel_2000@yahoo.co.uk,
[2] Mechnical Engeneering Dept. Technological Center, Federal University of Santa Catarina, PO.Box 476, Florianopolis, SC, Brazil.

* Corresponding author
# Presenting author

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A study utilizing ozone (O_3) and vacuum packaging to find out their effect on in-shell Brazil nuts fungi and aflatoxin (AFL) degradation was carried out together with lipid stability and sensory evaluation after 60 days of storage at 26ºC. In-shell Brazil nuts were O_3 treated at 31.5 mg/L (5h.), vacuum packaged in low oxygen permeability polyethylene bags, heat sealed and stored (Group I). Groups of in-shell nut packs were kept for Control: with (Group II) and without (Group III) vacuum. The nuts initial fungi load was 4.83 log cfu/g, moisture content of 9.37% and 11.58 µg/kg of AFLs. Any fungi load change (on MEA media), *Aspergllus flavus* and *parasiticus* (on AFPA media) growth/inhibition, AFL presence (analyzed either in-shell and after shelling by LC/FD), lipid oxidation (TBA test) and nut acceptance/rejection by sensory evaluation (attributes: nut shell and edible part appearance, strange odor, residual taste, rancidity and firmness) were registered. Right after the O_3 treatment no fungi and yeast count (cfu), neither the toxigenic species of *Aspergillus* (*A. parasiticus* and/or *A. flavus*) growth were detected in the nuts and the same persisted throughout the whole storage period. As expected, different behavior was observed in the Control Groups. In Group II, the nuts kept similar fungi count as the beginning of the experiment; however, slightly lower, probably due to lack of oxygen by the vacuum environment. With the exposure to O_3, AFLs were not detected up to the LOQ of the method (0.50; 0.17; 0.50; 0.17 µg/kg) since Day One and up to the end of the storage, different to the untreated nut packs (Control Groups). The sensory evaluation showed that nuts O_3 treated and vacuum packaged were still palatable and were accepted by the panelist groups with scores ranging from 4 (like) to 5 (like very much), with no significant changes ($p<0.05$) between nut sensory attributes per panelist. From the data obtained, O_3 gas did not affect the lipids of the treated in-shell Brazil nuts vacuum packaged. The malonaldehyde values were constant throughout the whole storage period. The data obtained here on O_3 + vacuum + packaging showed that it can be an alternative procedure, easy to apply, for transporting in-shell Brazil nuts through long distances such as: in the forest (raw) by boat in the long and curved Amazon river, or during export by ship trips can last 3 to more weeks.