Atmospheric Cold Plasma Antifungal Treatment of Maize (*Zea Mays* L.) for Storage and its Effect on Germination

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Maize (*Zea mays* L.) crop stands out for its diverse applications, either, for humans and animals consumption. Grains can get contaminated by fungi and their toxic metabolites (mycotoxins), which can reach animals meat and milk (fed contaminated maize-based feed) for human consumption. There is a need of mitigating contamination. Although applications using synthetic fungicides already exist, they may leave harmful residues. There is an urge for GRAS (Generally Recognized as Safe) prevention and control methods (less invasive and efficient) for the production chain, especially storage and their evaluation are a priority. Tthis work investigated a GRAS antifungal instrumental method – Atmospheric Cold Plasma (ACP) and its effect on grains germination for storage. Maize (naturally contaminated– 4.00±0.41/4.39±0.63/4.35±0.36 logTFLg^{-1}), at three different moisture contents (10, 15 and 20%), were exposed to ACP. In a dielectric discharge barrier reactor (130 Hz, 30 kV, 100±5 mJ, 0.8 cm electrode distance, under atmospheric pressure and air as ionizing gas) at increasing exposure times from 2.0 to 20 min. Subsequently, grains were evaluated for effects on fungal reduction and germination capacity (Seed Pads). Data showed that the ACP treatment was effective on reducing fungal contamination (mainly from 10 min exposure time), showing a higher logarithmic reduction at 15 and 20 min (from 0.94±0.42 to 1.46±0.53 log TFLg^{-1}). Being the moistures not significantly influenced the ACP effectiveness ($p<0.05$). Regarding the ACP effect on grains germination (TG_{ACP}), despite of its potential to reduce fungal contamination (from 2 to 20 min), it did not compromise the germination capacity up to 10 min (2.0/5.0/7.0/10.0 min) of exposure ($p<0.05$). However, at longer ACP exposure (15 and 20 min) reduction of the gemination rate (radicle formation) was registered. Probably due to the ACP reactive species formation, causing tissues expansion and cell membranes rupture. Despite that, for most of storage, germination is not expected (for grains-food purposes, different for seeds-

planting purpose), as it interferes to the top of silo forming a thick & moist layer of germinated grains leading to fungi growth. These results indicate that ACP may be a viable non-thermal instrumental alternative and effective strategy for controlling fungal contamination in stored maize grains - as it controls germination at longer exposure time. Future pilot-scale studies are needed to detail the logistics for implementation in grain Warehouses (by installing the equipment on/at grain conveyors).

Keywords: cold plasma, non-thermal technology, antifungal, maize.