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Impact of Ozone Treatment on Seed Germination – A Systematic Review

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ABSTRACT

Rising world population necessarily increases the food requirement. At the same time, agricultural land has been reduced drastically due to the rapid urbanization and industrialization which severely affects the land availability for the growers. However, the enhancement of seed germination has the potential to secure the food safety of masses by improving crop production. The traditionally followed chemical methods to improve seed germination have major limitations including being environmentally unhealthy, time-consuming, and are labor-intensive. Of late the application of ozone on plant growth and seed germination has attained greater significance. This promising technique and its various potential applications in the food industry have started emerging. Ozone is a strong antimicrobial agent as well as a germination enhancer. Ozone, in limited quantity, enhances seed germination rate; on the other hand, excess ozone can also cause some negative effects. Generally, ozone is applied either in gaseous or aqueous phases; however, the method and treatment conditions of ozone vary with the subject samples. This review mainly discusses the impact of ozone treatment on seed germination, the quality changes that accompany the treatment as well as the factors affecting the efficiency of ozone.

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Introduction

Seeds are a basic component of the agricultural system not only as a source for the perpetuation of a genotype but also form an integral component of the food basket. Cereals alone contribute half of the world's per capita food consumption. The seed is a dispersal unit and it physiologically sustains the developing seedling until the latter emerges as an independent and autotrophic life form. Germination involves various activities that begin with the uptake of water by the quiet dry seed and end with the lengthening of the embryonic axis (Bewley and Black 1994). All the metabolic and cellular mechanisms that occur prior to germination in the non-dormant seeds also occur in soaked up dormant seeds. Hence, a dormant seed may accomplish the majority of the metabolic advances required to complete its germination, yet for some incomprehensible reasons, the embryonic axis (i.e., the radicle) does not emerge (Bewley 1997).

Seed germination is considered as a highly susceptible and important stage in the life cycle of a plant as it is influenced by both the intrinsic and extrinsic factors. Temperature is a major environmental factor that determines the seed germination (Finch-Savage. and Leubner-Metzger 2006). Temperature affects the contents of phytohormones, gibberellins and abscisic acid in the seed and hence influences the germination process (Finch-Savage. and Leubner-Metzger 2006). Fluctuating temperature brings the physiological equilibrium among the promoter hormones and plant growth inhibitors. During the low-temperature cycle, the inhibitors are decreased whereas under high-temperature conditions the activity of promoter hormones rises which leads to germination (Copeland and McDonald 2012). Salinity and water deficit are the key natural factors that can prevent seed germination. Of the important edaphic factors that affect the dispersion and establishment of plants is soil pH (Amini, Zaefarian, and Rezvani 2015; Rezvani and Yazdi 2013;

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