

DEVELOPMENT OF A CYLINDRICAL EB SOURCE WITH RADIALLY OUTWARDS DIRECTED ELECTRON FLOW FOR COST-EFFICIENT PHYTOSANITARY TREATMENT OF SEEDS

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ABSTRACT

The phytosanitary treatment of seeds before planting with accelerated electrons offers a purely physical, environmentally friendly alternative to chemical dressing. While pathogens on and within the seed coat are reliably inactivated by this method, the embryo remains unaffected. This is possible because the penetration range of the electrons can be precisely tuned by the acceleration voltage of the beam generator. Depending on the seed variety, tailored recipes make sure that the recommended amount of energy is applied with appropriate surface uniformity and depth distribution. To integrate the electron treatment into seed production workflows, several container-integrated units (comprising the electron sources, power supplies, control system, supply and media distribution) were transferred into production over the past years. These units are highly productive and can treat (depending on the crop type) up to 25 tons / hour but they also require significant investment and, hence, large annual product throughput for amortization. Therefore, the main objective of the presented source development was to make the electron treatment economically appealing even for customers with smaller annual volumes (below 5,000 tons). In close collaboration with RAUSSENDORF GmbH, a mobile, modular and small container system was designed, which, following electron treatment, also allows for the application of biological plant strengtheners – organic fertilizers or symbiotic bacteria and fungi that promote plant growth, enhance nutrient uptake or protect against soil-borne pests and diseases.



As a key component for this machine concept, Fraunhofer FEP has developed a novel cylindrical electron source which emits electrons into atmosphere radially outwards to treat the surrounding curtain of falling seed, facilitating a throughput of about 10 tons / hour, which fits the typical productivity of upstream and downstream processes in commercial seed processing plants well. Like the linear sources previously available, this source is designed for acceleration voltages up to 150 kV and a rated power of 30 kW. However, by housing all the components for electron emission and acceleration inside the cylinder, significant savings are achieved in terms of space requirements and manufacturing costs.