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Influence of cryogenic treatment on micro-structural characteristics of some Indian spices: X-ray micro-tomography investigation

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1 **Influence of cryogenic treatment on micro-structural characteristics of some**
2 **Indian spices: X-ray micro-tomography investigation**

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11 **ABSTRACT**

12 Spices are ground cryogenically to retain their thermo-sensitive flavoring compounds; thereby,
13 producing a high-quality powder. In the cryogenic grinding process, spices are initially precooled
14 with a cryogen (Liquid nitrogen; LN₂) followed by grinding. To simulate and model, **breakage**,
15 **fluid** and heat transport phenomena, an insight of a spice micro-structure is required. Thus, the
16 article aims to investigate the effect of cryogenic treatment on micro-structural characteristics of
17 some Indian spices namely black pepper, cinnamon, king chili, and fenugreek. X-ray micro-
18 computed tomography (X-ray μ CT) coupled with image analysis was used to observe
19 quantitative parameters along with two- and three- dimensional images of micro-structure of the
20 spices. Dimensional details, color, moisture **level**, and volatile oil content of the samples were
21 also elaborated in line. The micro-structural changes of cryogenically treated (LN₂ dipped)

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