

## Thermodynamic Properties of Galmi Violet, Safari, Gandiol F1 and Orient F1 Onion Varieties

### Ngoné Fall Beye \*

Department of Food Technologies, UFR of Agronomic Sciences, Aquaculture and Food Technologies, Gaston Berger University, Saint-Louis, Senegal

Laboratory for Biological Sciences, Agronomy and Complex Systems Modeling (LaBAM) / Gaston Berger University, Saint-Louis, Senegal

Center for Studies on Food Safety and Functional Molecules- RESCIF, Polytechnic School (ESP), Dakar, Senegal

Water, Energy, Environment and Industrial Processes Laboratory (L3EPI), Polytechnic School (ESP), Dakar, Senegal

### Cheikhou Kane

Center for Studies on Food Safety and Functional Molecules- RESCIF, Polytechnic School (ESP), Dakar, Senegal

Water, Energy, Environment and Industrial Processes Laboratory (L3EPI), Polytechnic School (ESP), Dakar, Senegal

### Alioune Sow

Department of Food Technologies, UFR of Agronomic Sciences, Aquaculture and Food Technologies, Gaston Berger University, Saint-Louis, Senegal

Laboratory for Biological Sciences, Agronomy and Complex Systems Modeling (LaBAM) / Gaston Berger University, Saint-Louis, Senegal

### Francisca Nadège Sètonджи Vodounnou

Department of Food Technologies, UFR of Agronomic Sciences, Aquaculture and Food Technologies, Gaston Berger University, Saint-Louis, Senegal

### Nicolas Cyrille Ayessou

Center for Studies on Food Safety and Functional Molecules- RESCIF, Polytechnic School (ESP), Dakar, Senegal

Water, Energy, Environment and Industrial Processes Laboratory (L3EPI), Polytechnic School (ESP), Dakar, Senegal

### Abdou Sene

Laboratory for Biological Sciences, Agronomy and Complex Systems Modeling (LaBAM) / Gaston Berger University, Saint-Louis, Senegal

### Abstract:

**Context:** In Senegal, onions (*Allium cepa* L.) remain the second most important agricultural crop in terms of production. However, post-harvest losses remain considerable, and long-term solutions are needed to benefit consumers and farmers alike. Simple and effective, drying could be a sustainable and ecological solution.

**Objective:** In this context, the objective of this work is to determine certain thermodynamic properties which are decisive for the choice of the type of dryer.

**Methodology:** The onion varieties Galmi Violet, Safari, Gandiol F1 and Orient F1 from Senegal were selected. Placed at different temperatures (50°C, 55°C, 60°C and 65°C), the desorption isotherms were determined by gravimetric method. So, using the Clausius Clapeyron equation and the

Henderson model, which best describes the desorption process for each variety and the mixture of the four, net isotheric heat, entropy and Gibbs free energy were calculated.

**Results:** The results show that net isotheric heat and entropy decrease with increasing equilibrium moisture content. Furthermore, the net isotheric heats of desorption for 5% equilibrium moisture contents are 156.92; 141.37; 115.89, 127.39 and 128.19 KJ mol<sup>-1</sup> respectively for the varieties Galmi Violet, Safari, Gandiol F1, orient F1 and the mixture of the four. Thermodynamically, the net isotheric heat-entropy compensation theory is verified with isokinetic temperatures of 385.04°K (Galmi Violet); 386.2°K (Safari); 388.7°K (Gandiol F1), 398.37°K (Orient F1) and 397.12°K (the mixture of the four varieties).

**Conclusion:** The desorption process is controlled by the net isotheric heat [isokinetic temperatures > harmonic temperature (329.95 °K)] and desorption is spontaneous ( $\Delta G$  between -10.38 and -3.37 KJ mol<sup>-1</sup>).

**Keywords:**

Modeling, desorption isotherms, *Allium cepa* L, Varieties, net isotheric heat, isokinetic temperature.