Evaluation of The Overall Heat Transfer Coefficient on Industrial Malaxers Using a Simple Approach

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***Abstract.*** In the extra virgin olive oil processing, malaxation is a key-operation, during which the operative parameters should be strictly controlled both to maximize the oil extraction and to modulate the quality profile. However, the malaxer temperature control is not efficient due to the low ratio between heat transfer surface and olive paste volume and a the high viscosity of the matrix. In this study, the overall heat transfer coefficient U, was measured on 3 type of malaxers, applying the double-pipe heat exchanger model to unsteady-state conditions, according to Leone et al. (2015). The processing temperature of fluids and olive paste specific heat were collected during the experimental trials in order to determine U values, shown in Table 1. These represent a preliminary result on comparing the heat transfer coefficient of different malaxers in a relative way. The optimization of a simple method could be a useful tool for producers in order to assess with small effort the machine performances on an industrial scale.

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|  | **Vertical Malaxer** | **Horizontal Malaxer** | **Prototype Malaxer** |
| Malaxing units | 1 | 1 | 5 |
| Total capacity | 500 kg | 400 kg | 350 kg |
| Tank shape | Craddle | Cylindrical | Cylindrical |
| Size (for single unit) | 80 cm ID, 120 cm H | 150 cm L, 70 cm H, 60 cm W | 30 cm ID,140 cm H |
| Heat transfer surface or A | 3.0 m2 | 2.1 m2 | 5.8 m2 |
| **U (W m-2 °C-1)** | 73.8 ± 7.5 | 101.3 ± 0.9 | 185.5 ± 3.2 |
| **UA product (W °C-1)** | 222.2 ± 22.5 | 212.6 ± 1.8 | 1077.7 ± 18.6 |
| *ID=Internal Diameter, H=Height, L=Length, W=Width* |

***Table 1.*** *Malaxer characteristics and coefficient results (mean ± standard deviation, n=3).*

**References**. A. Leone, A. Tamborrino, R. Zagaria, E. Sabella, R. Romaniello, Plant innovation in the olive oil extraction process : A comparison of efficiency and energy consumption between microwave treatment and traditional malaxation of olive pastes, J. Food Eng. 146 (2015) 44–52.