Supplementary Information

Appendices

Appendix A

The mathematical equations presented herewith are an integral part of the description that models the phenomenon of mass transfer, considering the first term of the infinite series.

$$W=\frac{1}{b}\sqrt{\frac{2}{\pi\lambda_1}}\left\{\frac{\mathcal{D}_S}{\mathcal{D}_F}\left(\frac{r_0}{r_s-r_0}\right)\left[\sin(\lambda_1)+\left(\frac{\lambda_1\cos(\lambda_1)-\sin(\lambda_1)}{\lambda_1\sin(\lambda_1)+\cos(\lambda_1)}\right)\cos(\lambda_1)\right]\right\} \qquad (A.1)$$

$$\int_A^1 R^2\,\phi_{1(R)}dR=\sqrt{\frac{2}{\pi\lambda_1}}\left\{\frac{1}{{\lambda_1}^2}[\sin(\lambda_1)-\sin(\lambda_1 A)]-\frac{1}{\lambda_1}[\cos(\lambda_1)-A\cos(\lambda_1 A)]+\right.$$
$$\left.\frac{[\lambda_1\cos(\lambda_1)-\sin(\lambda_1)]}{[\lambda_1\sin(\lambda_1)+\cos(\lambda_1)]}\left[\frac{1}{{\lambda_1}^2}[\cos(\lambda_1)-\cos(\lambda_1 A)]-\frac{1}{\lambda_1}[\sin(\lambda_1)-A\sin(\lambda_1 A)]\right]\right\} \qquad (A.2)$$

$$b=\frac{1}{\pi\lambda_1}\left\{\left[(1-A)+\frac{\sin(2\lambda_1 A)-\sin(2\lambda_1)}{2\lambda_1}\right]+\frac{2}{\lambda_1}\frac{[\lambda_1\cos(\lambda_1)-\sin(\lambda_1)]}{[\lambda_1\sin(\lambda_1)+\cos(\lambda_1)]}[\sin^2(\lambda_1)-\sin^2(\lambda_1 A)]+\right.$$
$$\left.\frac{[\lambda_1\cos(\lambda_1)-\sin(\lambda_1)]^2}{[\lambda_1\sin(\lambda_1)+\cos(\lambda_1)]^2}\left[(1-A)-\frac{\sin(2\lambda_1 A)-\sin(2\lambda_1)}{2\lambda_1}\right]\right\} \qquad (A.3)$$

$$A_0=\frac{6}{(1-A^3)}{R_{\lambda_1}}^2 \qquad (A.4)$$

$$A_1={\lambda_1}^{2.0031} \qquad (A.5)$$

wherein

$$R_{\lambda_1}=(B_3C_3)-(D_3E_3)+A\lambda_1(B_3E_3+D_3C_3) \qquad (A.6)$$

In addition:

$$B_3=\frac{\cos(\lambda_1 A)}{\lambda_1} \qquad (A.7)$$

$$C_3=\frac{1}{\lambda_1}[\sin(\lambda_1)-\sin(\lambda_1 A)]+[A\cos(\lambda_1 A)-\cos(\lambda_1)] \qquad (A.8)$$

$$D_3=\frac{\sin(\lambda_1 A)}{\lambda_1} \qquad (A.9)$$

$$E_3=\frac{1}{\lambda_1}[\cos(\lambda_1)-\cos(\lambda_1 A)]+[\sin(\lambda_1)-A\sin(\lambda_1 A)] \qquad (A.10)$$

The preceding enables us to derive the mathematical formulas that facilitate the computation of the effective diffusion coefficients in the skin and flesh of cherries.

$$\mathcal{D}_F=\left|\ln\left(\frac{a\,\beta}{\alpha+\beta}\right)\right|\frac{{r_0}^2}{({\lambda_1}^3-{\lambda_1}^2)\,t} \qquad (A.11)$$

$$\mathcal{D}_S=\lambda_1\ \tan(\lambda_1)\left|\ln\left(\frac{a\,\beta}{\alpha+\beta}\right)\right|\frac{1}{({\lambda_1}^3-{\lambda_1}^2)\,t}(r_s r_0-{r_0}^2) \qquad (A.12)$$

Appendix B

Upon the development of the analytical expressions that model the molecular diffusion behaviour of the substances, the subsequent expressions elucidate each variable inherent in equations (A.11) and (A.12).

$$\alpha=\text{Nº1 Nº2 Nº6} \qquad (B.1)$$

$$\beta=\text{Nº2 Nº3 Nº4 Nº5 Nº6} \qquad (B.2)$$

It is described a mathematical equation that involves six functions, designated as Nº1 to Nº6. These functions are dependent on a variable λ_n, eigenvalues, to clarify, $\text{Nº}_i=f_i(\lambda_n)$:

$$\text{Nº1}=A_2B_2 \qquad (B.3)$$

$$\text{Nº2}=C_2-D_2+E_2(F_2+G_2) \qquad (B.4)$$

$$\text{Nº3}=A_2H_2 \qquad (B.5)$$

$$\text{Nº4}=I_2J_2 \qquad (B.6)$$

$$\text{N º5}=K_2 \qquad (B.7)$$

$$\text{Nº6}=M_2 \qquad (B.8)$$

Where:

$$A_2 = \frac{3}{(1-A^3)} \quad (B.9)$$

$$B_2 = \frac{\mathcal{C}_i}{b}\sqrt{\frac{2}{\pi\lambda_1}} \quad (B.10)$$

$$C_2 = \frac{1}{{\lambda_1}^2}[\sin(\lambda_1) - \sin(\lambda_1 A)] \quad (B.11)$$

$$D_2 = \frac{1}{\lambda_1}[\cos(\lambda_1) - A\cos(\lambda_1 A)] \quad (B.12)$$

$$E_2 = \frac{[\lambda_1\cos(\lambda_1) - \sin(\lambda_1)]}{[\lambda_1\sin(\lambda_1) + \cos(\lambda_1)]} \quad (B.13)$$

$$F_2 = \frac{1}{{\lambda_1}^2}[\cos(\lambda_1) - \cos(\lambda_1 A)] \quad (B.14)$$

$$G_2 = \frac{1}{\lambda_1}[\sin(\lambda_1) - A\sin(\lambda_1 A)] \quad (B.15)$$

$$H_2 = \frac{1}{b}\sqrt{\frac{2}{\pi\lambda_1}} \quad (B.16)$$

$$I_2 = \left[\frac{\frac{D_S}{r_S - r_0}}{\frac{D_L}{r_0}}\right] = \lambda_1\tan(\lambda_1) \quad (B.17)$$

$$J_2 = \sin(\lambda_1) + \frac{[\lambda_1\cos(\lambda_1) - \sin(\lambda_1)]}{[\lambda_1\sin(\lambda_1) + \cos(\lambda_1)]}\cos(\lambda_1) \quad (B.18)$$

$$K_2 = \frac{A_0}{{\lambda_1}^2 - A_1} \quad (B.19)$$

$$M_2 = \sqrt{\frac{2}{\pi\lambda_1}} \quad (B.20)$$