International Journal of Innovation in Science and Mathematics
Volume 2, Issue 1, ISSN (Online): 2347–9051

A Theoretical Model of the Diffusion Process to Spherical and Isotropic Fruits

Mariela B. Maldonado
Research Scientist (CONICET), Argentina
Instituto Nacional de Tecnología Agropecuaria,
EEA-Mendoza (INTA), San Martín 3853, (5507) Mayor Drummond, Mendoza, Argentina.
Email: maldonado.mariela@inta.gob.ar

Raul C. Perez
Univesidad Tecnológica Nacional
Facultad Regional, Mendoza

Abstract – **Many models are using now in order to can study of the table green olives diffusion process. Different models had been consistent in order to determinate the magnitude order of the diffusion coefficient effectiveness; we can to mention the thin plate model, the hollow cylinder and the hollow sphere model. But none them describe geometrically in a correct way this fruit.**

For this reason, we had developed a new model to spherical and isotropic fruits in order to can to adapt its diffusion behavior with the same geometry. So, all spherical isotropic fruit with pit are in conditions of to be treaty with this method.

Keywords **– Diffusion, Olive, Spherical Fruits, Solution.**

I. Introduction

Shape and size are inseparable in a physical object, and both are necessary if the object is to be satisfactorily described. Futhre, in definining the shape some dimensional parameters of the object must be measured. In order to can to model the diffusion process of the solution into the spherical fruits with pits; we had developed a mathematical and theoretical method. The proposal of this work is to get a way in order to describe physically these processes and it to know the behavior of the variables and parameters that intervene.

With this model it will be possible to predict and calculate the characteristic and property of diffusion problem in fruits, and also its evolution on the time. Of course, the model has its conditions of application, because we had

II. Materials and Methods

A. Theoretical Treatment

We consider the fruit as an isotropic sphere with the external radius R_0 on the pulp fruit surface (internal skin radius), and it has in the centre a pit with radius R_i (pit radius), as show below of the figure 1.

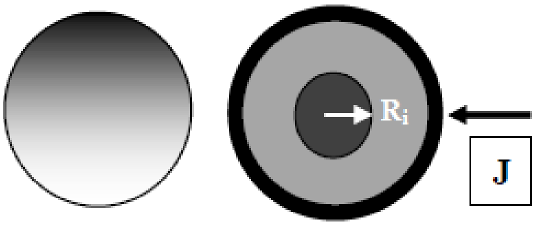

Fig1. The scheme of the isotropic spherical olive

The concentration flux J that goes through skin to pulp is:

$$J = -D\nabla C \quad (1)$$

Where D is the diffusion coefficient; and ∇C is the solution concentration gradient. If we resolve the problem in spherical coordinates with the assumption mentioned, the equation 1 will be:

$$J = -D\frac{dC}{dr} \quad (2)$$

We are called at the dimensionless radius expression r = R/Ro. So, the diffusion differential equation is:

$$\frac{\partial^2 C}{\partial r^2} + \frac{2}{r}\frac{\partial C}{\partial r} = \frac{\partial C}{D\partial t} \quad (3)$$

In order to can resolve the equation 3, we define de function :

$$u(r,t) = c(r,t).r \quad (4)$$

If we replace the equation 4 into the equation 3, and it become in:

$$\frac{1}{D}\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial r^2} \quad (5)$$

Now, in order to can resolve the equation 5, we propose as solution a function of the form:

$$u(r,t) = F(r).T(t) \quad (6)$$

With the conditions:

$u(r = a, t) = 0 \; to \; t > 0 \quad and$

$u(r = 1, t) = C_0 \; to \; t > 0.$

Where C_0 is the constant concentration at the surface or the sphere and $\alpha = R_i/R_0$ is the dimensionless radius expression of the pit radius that represent the differentially surface under the surface pit where C = 0 to t > 0; because we assume that there is not flux from the pulp to the inner pit.

If we put this expression into the equation 5, let us:

$$\frac{1}{DT}\frac{dT}{dt} = \frac{1}{F}\frac{d^2F}{dr^2} = m^2 \quad (7)$$

The left side of the differential equation 7, depend only of the time; and the right side depend only of the radius r. If both side of equation 7 are equal, the unique possibility is that they are equal a constant, we called at this constant m^2.

Now we can resolve the equation 7 in 2 parts to separate:

$$\frac{1}{F}\frac{d^2F}{dr^2} = m^2 \quad (8.a)$$

$$\frac{1}{DT}\frac{dT}{dt} = m^2 \quad (8.b)$$

In order to can resolve the equation 8.a, we propose a solution:

$$F(r) = e^{\propto r} \quad (9)$$

If we replace and re-arraying, we can to obtain $\propto = \mp m$, and the definitive expression to radial function F(r) is:

$$F(r) = A.e^{mr} + B.e^{-mr} \quad (10)$$

Using de condition that $u(r = a, t) = 0\ to\ t > 0$, we ca obtain:

$$F(a) = A.e^{ma} + B.e^{-ma} = 0$$

then $B = -A.e^{2ma}$

If we replace this result into the equation 10, then the radial function is:

$$F(r) = A\left[e^{mr} - e^{m(2a-r)}\right] \quad (11)$$

In order to find the A expression we can use the other boundary condition that establish $u(1,t) = C_0\ to\ t > 0$, so we obtain:

$$F(1) = A\left[e^{m} - e^{m(2a-1)}\right] = C_0$$

And removing A, we get:

$$A = \frac{C_0}{\left[e^{m} - e^{m(2a-1)}\right]} \quad (12)$$

So, the radial function expression is

$$F(r) = \frac{C_0}{\left[e^{m} - e^{m(2a-1)}\right]}\left[e^{mr} - e^{m(2a-r)}\right] \quad (13)$$

and the $u(r,t)$ expression is:

$$u(r,t) = \frac{C_0}{\left[e^{m} - e^{m(2a-1)}\right]}\left[e^{mr} - e^{m(2a-r)}\right].T(t) \quad (14)$$

In order to get the complete expression of $u(r,t)$ we need now to resolve the differential equation 8.b. If we assume that the diffusion coefficient D change on the time, we need to know the time expression the D with t. We consider the lineal approximation of its time serial developed, so we assume as the time dependence expression of the D:

$$D(t) = a_0 + a_1 t \quad (15)$$

Where a_0 and a_1 are constant that have the all properties and characteristics physics and chemistry of the diffusion coefficient D and we must to determinate. So, we can resolve the equation 8.b:

$$\frac{dT}{T} = m^2 D(t)dt \quad (16)$$

Integrating both members we have:

$$T(t) = T_0 e^{m^2 \int_0^t D(t)dt} \quad (17)$$

Where T_0 is the T(0) function value when t=0. In order to get the complete expression of the time function T(t); we need integrate the equation 15, so we obtain that:

$$\int_0^t D(t)dt = a_0 t + a_1 t^2 + b \quad (18)$$

If we replace this result into the equation 17, we obtain:

$$T(t) = T_0 e^{m^2(a_0 t + a_1 t^2 + b)} \quad (19)$$

Then combining this result whit the equation14, the complete expression of the $u(r,t)$ function is:

$$u(r,t) = \frac{T_0.C_{0.}}{\left[e^{m} - e^{m(2a-1)}\right]}\left[e^{mr} - e^{m(2a-r)}\right].e^{m^2(a_0 t + a_1 t^2 + b)} \quad (20)$$

and the concentration function C(r,t) that describe its behavior is:

$$C(r,t) = \frac{u(r,t)}{r}$$

$$= \frac{T_0.C_{0.}}{\left[e^{m} - e^{m(2a-1)}\right]}\frac{\left[e^{mr} - e^{m(2a-r)}\right]}{r}.e^{m^2(a_0 t + a_1 t^2 + b)} \quad (21)$$

We must to find the value of the constants T_0, C_0, a_0, a_1 and b if we want to know the exact solution of C(r,t). In order to get these values, we will resort at the experimental measure. So if we measure the concentration $C(1,t_0)$ on the fruit surface at the time $t_{0,}$ the equation 21 will be:

$$C(1,t_0) = T_0.C_{0.}.e^{m^2(a_0 t_0 + a_1 t_0^2 + b)} \quad (22)$$

Then we have:

$$C(1,t_0).e^{-m^2(a_0 t_0 + a_1 t_0^2 + b)} = T_0.C_{0.} \quad (23)$$

If we replace the equation 23 in the equation 21, we obtain:

$$C(r,t) = \frac{C(1,t_0)}{\left[e^{m} - e^{m(2a-1)}\right]}\frac{\left[e^{mr} - e^{m(2a-r)}\right]}{r}.e^{m^2[a_0(t-t_0) + a_1(t^2 - t_0^2)]} \quad (24)$$

Moreover, we wish to decrease de constant number of the equation 24. Then we use the fact that describe before, when we saw that C_0 is the constant concentration at the surface or the sphere and $a = R_i/R_{0.}$ In other words, the temporal derivate of the concentration on the surface is zero. Then we have that:

$$\left|\frac{\partial C(r,t)}{\partial t}\right|_{r=1} = C(1,t_0).e^{m^2[a_0(t-t_0)+a_1(t^2-t_0^2)]}m^2$$
$$[a_0(t-t_0) + a_1(t^2 - t_0^2)](a_0 + a_1.2.t) = 0$$

Then:

$$[a_0(t-t_0) + a_1(t^2 - t_0^2)](a_0 + a_1.2.t) = 0 \quad (25)$$

The solutions to equation 25 are:

$$a_0 = -2a_1 t \quad and \quad a_0 = -a_1\frac{(t^2 - t_0^2)}{(t - t_0)} = -a_1(t + t_0) \quad (26)$$

If we include this expression in the exponential argument of the equation 24, we find that:

$[a_0(t-t_0) + a_1(t^2 - t_0^2)] = [-2a_1(t^2 - tt_0) +$ *a1t2−t02= a12tt.0−t2−2t02* (27a)

and:

$[a_0(t-t_0) + a_1(t^2 - t_0^2)] = [-a_1(t^2 - t_0^2) +$ *a1t2−t02= 0* (27.b)

The equation 27.b represent the trivial solution $a_1 = a_1$, then it do not contribute to get the final expression; so, we use the equation 27.a in order to replace into the equation 24; and we have that:

$$C(r,t) = \frac{C(1,t_0)}{\left[e^{m} - e^{m(2a-1)}\right]}\frac{\left[e^{mr} - e^{m(2a-r)}\right]}{r}.e^{m^2 a_1[2tt_{.0} - t^2 - 2t_0^2]}$$

$(t > t_o)$ (28)

In order to decrease the constant numbers, we can make other experimental measure of the C(r,t) at other time t_1 on the surface, we can to named a this value as $C_1 = C(1,t_1)$, we will have:

$$C_1 = C(r,t_1) = C(1,t_0).e^{m^2 a_1[2t_1 t_{.0} - t_1^2 - 2t_0^2]} \quad (29)$$

Then we can to write:

$$m^2 a_1[2t_1 t_{.0} - t_1^2 - 2t_0^2] = \ln\left[\frac{C(1,t_0)}{C_1}\right] \quad (30)$$

or $$a_1 = \frac{\ln\left[\frac{C(1,t_0)}{C_1}\right]}{m^2[2t_1 t_{.0} - t_1^2 - 2t_0^2]}$$

Now we can introduce the equation 30 into the equation 28 and we will have:

International Journal of Innovation in Science and Mathematics
Volume 2, Issue 1, ISSN (Online): 2347–9051

$C(r,t) =$

$$\frac{C(1,t_0)}{[e^m - e^{m(2a-1)}]}\frac{[e^{mr} - e^{m(2a-r)}]}{r}.e^{\left[\frac{2tt_0 - t^2 - 2t_0^2}{2t_1t_0 - t_1^2 - 2t_0^2}\right]\ln\left[\frac{C(1,t_0)}{C_1}\right]} \quad (31)$$

In order to simplify the equation 31, we consider $t_0 = 0$ without loss generality. So the equation 31 let us:

$$C(r,t) = \frac{C(1,t_0)}{[e^m - e^{m(2a-1)}]}\frac{[e^{mr} - e^{m(2a-r)}]}{r}.e^{\left(\frac{t}{t_1}\right)^2\ln\left[\frac{C(1,t_0)}{C_1}\right]} \quad (32)$$

The unique constant that is necessary determinate now is *m*. A way possible in order to get know *m* is to make other measurement of the concentration C(r,t) at the time t_0 on a dimensionless radius b between r= a to r=1. So, we have:

$$C(b,t_0) = \frac{C(1,t_0)}{[e^m - e^{m(2a-1)}]}\frac{[e^{mb} - e^{m(2a-b)}]}{b} \quad (33)$$

And if we operate in order to determinate *m:*

$$\frac{[e^{mb} - e^{m(2a-b)}]}{[e^m - e^{m(2a-1)}]} = \frac{C(b,t_0).b}{C(1,t_0)} \quad (34)$$

$$\left[e^{mb} - e^{m(2a-b)}\right] = \frac{C(b,t_0).b}{C(1,t_0)}\left[e^m - e^{m(2a-1)}\right] \quad (35)$$

or

$$\left[e^{mb} - e^{m(2a-b)}\right] - \frac{C(b,t_0).b}{C(1,t_0)}\left[e^m - e^{m(2a-1)}\right] = 0$$

We must to use the serial develop of exponential function ($e^x = 1 + x + \frac{x^2}{2!} + \ldots$) in the before expression to find the *m* expression. So we have:

$[2m(b - a) + am^2(b - 2a)] - [2m(1 - a) +$
am21−2aCb,t0.bC1,t0=0 (36.a)

or if we divide both members to *m* we obtain:

$[2(b - a) + am(b - 2a)] - [2(1 - a) + am(1 -$
2aCb,t0.bC1,t0=0
(36.b)

and now we can to remove *m* from to equation eq. 36.b

$$m = \frac{-2}{a}\frac{\left[(b-a)-(1-a)\frac{C(b,t_0).b}{C(1,t_0)}\right]}{\left[(b-2a)-(1-2a)\frac{C(b,t_0).b}{C(1,t_0)}\right]} \quad (37)$$

We can to determinate de constant *m*, it making two concentration measure C(r, t) at the initial time of the experience (t_0=0); one on the surface of the fruit pulp (r=1) and other a dimensionless radius r=b between r=a, and r=1. With these measurements, we can to calculate the *m* value using the equation 37; after with this value, we can to use it in the equation 32 in order to describe the behavior of the solution concentration C(r, t) into the fruit pulp at any time at any inner radius value that we wish.

A. The Diffusion Coefficient D:

We suppose in our work, that the diffusion coefficient D is time dependent as show the equation 15. If we use the equation 26 to include in equation 15 and remove a_0 we obtain:

$$a_0 = -\frac{a_1}{2}(3t + t_0) \quad (38)$$

and if we replacing this result into the equation 15, we have that:

$$D(t) = a_0 + a_1 t = -\frac{a_1}{2}(t + t_0) \quad (39)$$

Now, we can replace the expression a_1 from the equation 30 into the equation 39, it become in:

$$D(t) = -\frac{a_1}{2}(t + t_0) = -\frac{\ln\left[\frac{C(1,t_0)}{C_1}\right]}{2m^2[2t_1t_0 - t_1^2 - 2t_0^2]}(t + t_0) \quad (40)$$

Then, we can to describe also the behavior of the diffusion coefficient D with the time using the equation 40. We can to observe this behavior in the figure 4 made to an example with olives.

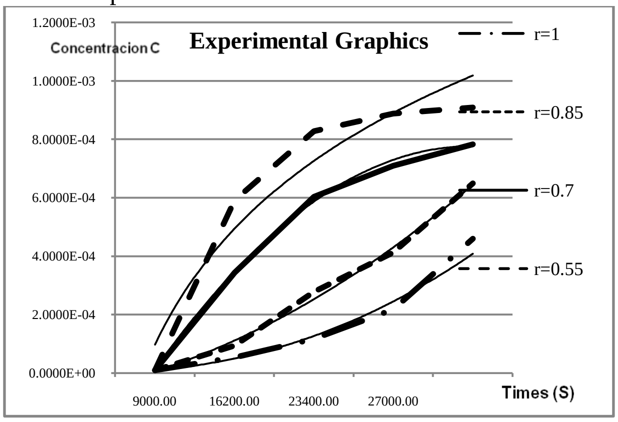

Fig.2. Graphics of solution concentration C(r,t) experimental value vs. time to olives submerged in ClNa.

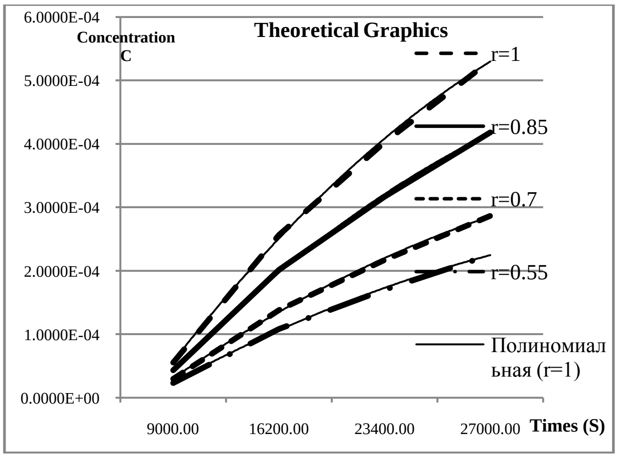

Fig.3. Graphics of solution concentration C(r,t) of the theoretical model value vs. time to olives submerged in ClNa.

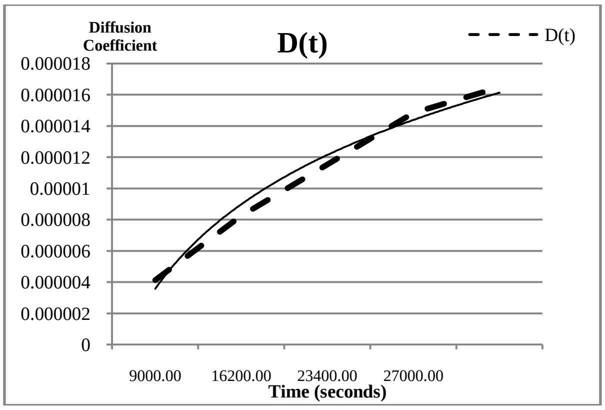

Fig.4. Graphics of diffusion coefficient D(t) of the theoretical model value vs. time to olives submerged in ClNa..

International Journal of Innovation in Science and Mathematics
Volume 2, Issue 1, ISSN (Online): 2347–9051

B. Synthesis:

If we want to know the behavior of the any solution concentration into the fruit pulp, at any time and any inner radius; it is enough to make three measures: two measures at initial time t_0, one on the surface of the pulp and another on the r=b (dimensionless inner radius between r = a and r =1). Moreover we need a last measure of the solution concentration C(r, t) that we must to make on the surface at a time t posterior t_0. With these data we can calculate the constant *m* using the equation 37.

Finally, we are in capacity to use the equation 32 to calculate the solution concentration of any spherical fruit at any time in any place into the pulp fruit. In the figure 3 we can see the graphics of the solution concentration value calculated in the time function to different dimensionless radius r to an example with olives; it is possible to compare this graphics with the experimental value showed in the figure 2.

An important question that we must to consider, it is that the equations 32 and 37 are strongly influenced by the a parameter. This fact it mean that we must to calculate by separate each fruit that has a different a value. We should remember that $a = \frac{R_i}{R_0}$; then, we can to affirm that exist equivalence to same spherical fruits that have the same value of the reason between pit R_i radius and pulp surface radius R_0 in the diffusion behavior under the same conditions. These concepts explain the correct use of the antique method called in Spanish as *"romaneo"*.

If we want, also we study the behavior of the diffusion coefficient using the equation 40.

III. Methodology of Work

In order to understand completely how we must to procedure to use the result obtained methodologically, we have that follow the next step:

1. The first step is measure of the R_i and R_0 to the fruit that we want to study, and with its value we must calculate the dimensionless radius $a = \frac{R_i}{R_0}$.
2. In the next step, we must separate fruits in groups with the equivalence in the a value. This fact corresponding to *"romaneo"* process. In to the practice it is enough to separate the fruits with similar surface radius R_0.
3. In the next step, we should to make two initial solution concentration measure C(r, t_0): one on the surface C(1, t_0) that we called C_0; an another in the inner the pulp at the dimensionless r=b (a < b < 1) C(b, t_0).
4. A third measure of the solution concentration measure C(r, t) it must be made at the time t_1 posterior to t_0 on the pulp surface that we called C(1, t_1) = C_1.
5. With the data of a , b, C(b, t_0) and C_0 we can to calculate the *m* value using the equation 37.
6. Now, with the anterior values and the calculus of *m*, we are in conditions to calculate the solution concentration C(r, t_0) using the equation 32 at any time to any radius r value. Of course, we need to use the C_1 in order to resolve it.
7. If we want to describe the behavior of the diffusion coefficient D on the time with the equation 40.

A. Development of an example of Application:

The methodology explained above, we had used to olives with size that is showed in the table 1 and the table 2. With them we had followed the step mentioned and obtained:

Table 1: Weight olive classification.

Group	Unit by Kg
A	80 to 120
B	From 121 to 160
C	From 161 to 200
D	From 201 to 240
E	From 242 to 280
F	Bigger to 281

Table 2: Characteristics measures to olives used

	Weight (kg)	equatorial diameter (m)	Length (m)	skin thickness (m)
Media	$5{,}3 \times 10^{-3}$	17.2×10^{-3}	27.6×10^{-3}	$4. \times 10^{-5}$
Variance	0.7×10^{-3}	1.1×10^{-3}	1.9×10^{-3}	0.4×10^{-5}

We had resolved the particular case of the olives submerged into ClNa solution, for this case we had obtained the follow measure:

1. The measures of the R_i and R_0 were: R_0=0.008 m., and R_i 0.0043 m. The calculus of $a = \frac{R_i}{R_0}$ was 0.005375.
2. The initial solution concentration measure on the surface value was C(1, t_0) = 5.9178×10^{-4} mg/g.; and in the inner the olive pulp at the dimensionless r = b = 0.86 the solution concentration measure C(b, t_0) was 3.44×10^{-4} mg/g.
3. The measure of the solution concentration measure C(r, t) at the time t_1 = 16200 seconds (4 hours 30 minutes) posterior to t_0 on the pulp surface was C(1, t_1) = 8.28 $\times 10^{-4}$ mg/g.
4. With these data we had calculated the *m* value using the equation 37; and we obtain *m*= 1.6624 m^{-1}.
5. Now, with the anterior values and the calculus of *m*, we calculate the solution concentration C(r, t_0) using the equation 32 at any time to any radius r value, and we obtain the value concentration that show in the table n°3, and also the curves of the graphics of the figure 3.
6. We can to describe the behavior of the diffusion coefficient D on the time with the equation 40. In our example we can observer this fact in the figure 4.

IV. Results and Discussion

When we compare the experimental measure with the theoretical results that show the figures 2 and 3; we can get a few observations:

1. The magnitude order of results between theoretical and empirical value is very close.
2. The increase behavior of the concentration C(r,t) with the time is similar.
3. The disagree that exist between theoretical and empirical value may be to many factors:

3.1 We had assumed when had resolved the diffusion differential equation, that the relation between the diffusion coefficient D and the time t is lineal. This approximation may be not enough good.

3.2 We had worked with the olives that are not perfect spherical fruits.
3.3 The data used to theoretical calculus are an average over sample with the similar dimension (*"romaneo"*), but we had not used real values that were measured in the experience.

However, we think that results that we obtain to the example showed with olives are very good if we consider the difference that exist between the real case and the theoretical approximation.

The next step in order to improve the model to olives and other fruits with the same form, it is resolve the diffusion differential equation in ellipsoidal coordinates.

V. Conclusions

In according with the equations obtained (32, 37 and 40), we had get interesting conclusions about of these results:

1. We had found an approximate theoretical model to spherical and isotropic fruits in order to can describe the dependence of the concentration with the time in its inner to any dimensionless radius r.
2. We get to model about of the behavior on the time of the diffusion coefficient D when the spherical fruits are submerged in any solution.
3. We had developed its equations in order to calculate the spherical fruits concentration value and the diffusion coefficient D to any time and any position inner the pulp from the only three experimental measures.
4. The behavior of the concentration in function of the time and radius depend of the R_i and R_0 values parameters; on others words, to case with different values of R_i and R_0, will be different respectively. These facts are in accord with the empirical treatment called "romaneo" in Spanish.

Acknowledgements

This work was financed by INTA: PNNAT 1128042 and CONICET. Developed it under the consideration that the fruit is spherical and isotropic; so, the fruit do not carry out these conditions they can not treat with this method.

References

[1] Amiot, M. J. ; Tacchini, M., Fleuriet, A. ; Macheix, J. J. 1990. *Le processus technologique de desamerisation des olives: caracterisation des fruits avant et pendant le traitement alcalin* [teneur en oleuropeine]. Sciences des Aliments. 10(3): 619-631

[2] Barranco, D., Fernández Escobar, D., Ballo, L.; 1997. *El cultivo del olivo. Coedición Junta de Andalucía*. Consejería de Agricultura y Pesca. Ediciones Mundi Prensa.

[3] Barret, A. y Bidón, P. 1964. *Quelques reserches recentes et leur aplication à la préparation des olives vertes de table*. Information Olèicoles Intern. Nouvelle, 25:53-63

[4] Beiser Arthur, Mexico 1970. *Conceptos de Física Moderna*. Ed. Mac Graw-Hill.

[5] Bird, R. B.; W. E. Stewart y E. N Lightfoot. 1973. *Fenómenos de Transporte*. Editorial Reverté.

[6] Crank, J. *"The Mathematics of Diffusion*". 1960. Oxford University Press.

[7] Fernández, M. H.; Uceda Ojeda, M.; García-Ortiz Rodríguez, A.; Morales Bernardino, J.; Friaz Ruiz, L. y Fernández García, A. 1991. Apuntes: *Elaboración de aceite de oliva de calidad*. *Junta de Andalucía Consejería de Agricultura y Pesca.* 5/91:36-38.

[8] Kopsidas, G. C. 1992. *A regression analysis on the green olives debittering. Grasse and Oils.* 42 (6): 401-403.

[9] Levich B. G., Moscu 1974. *Theoretical Physic.* Ed. Reverté.

[10] Maldonado, M. B. and Zuritz, C. A. 2004. *Determination of variable diffusivity of sodium during the debittering of green olives.* Journal of Food Process Engineering. Volume 27(5):345 -358.

[11] Maldonado, M. B. y Zuritz C. A. 2004(a). *Difusión de Sodio Durante el Tratamiento Alcalino de Aceitunas Variedad Aloreña*. International Journal of Fats and Oils. Revista Grasas y Aceites. Vol. 55 (4): 409-414.

[12] Maldonado, M.B. and C.A. Zuritz. 2003. *A model for diffusion of sodium in green olives at different temperatures and lye concentrations*. Journal of Food Process Engineering. Vol. 26: 336-359.

[13] Maldonado, M. B. and Zuritz, C. A. 2004. *"Determination of variable difusivity of sodium during the debittering of green olives.*" Journal of Food Process Engineering. Volume 27(5) :345 -358

[14] Garrido Fernández, A. *Elaboración de aceitunas de mesa.* Boletín de Servicios agrícolas de la FAO. Editorial Organización de la Naciones Unidas para la Agricultura y la Alimentación. p.33-34.

[15] Consejo Oleícola Internacional (COI). 2000. *Catálogo Mundial de Variedades de Olivo.*

[16] Drusas A.; Vagenas G. K. and Saravacos, G.D. 1988. *Diffusion of sodium chloride in green olives*. Journal of Food Engineering , 7:211-222.

[17] Código Alimentario Argentino. *Código Alimentario Argentino (CAA)* [en línea]. Capítulo XI: Alimentos Vegetales, artículo 950, actualizado a Junio de 2007.

[18] (Monograph Online Sources) *http://www.anmat.gov.ar/codigoa/Capitulo_XI_Vegetales_2007-05.pdf.* [Junio 2008]

Author's Profile

Maldonado Mariela Beatriz

Place of birth: Ciudad, Mendoza, Argentina. Date of birth: 25th April 1972. Doctora en Ciencias Biológicas, orientación Biología Celular y Molecular. PROBIOL. Universidad Nacional de Cuyo. Mza. Arg. 2004.Especialista en Docencia Universitaria. Posgraduate Degree. UNCuyo Nacional de Cuyo. Mendoza. Argentina. 2000.Especialista en Ingeniería de la Calidad. Posgraduate Degree. UTN 2000. Licenciada en Bromatología. UNC. Mendoza. Argentina.1997.Auditor Interno de la Calidad. Norms ISO 100011 e ISO 9001. Latin American Institute of Quality Insurance. (INLAC).
She is researcher in CONICET: National Council of Scientific and Technical Research.
Working place: INTA National Institute of Agroindustrial Technology. Address: San Martín 3853, Mayor Drummond, Luján Mendoza. Argentina . and Technical advisor in The Production, Technology and Innovation Ministry, for technical assistance in PROSAP projects agricultural service programs. Mendoza Government. Production, Technology and Innovation Ministry. Since 2010. She has written 7 Books e.g: "Difusión de sodio durante el desamarizado de aceitunas verdes de mesa". ISBN 978-3-8454-8334-4. España. 2011. 236p and 2 Book chapter e,g: Logistics; Perspectives, Approaches, and Challenges". Innovation in City Logistics- Chapter. The Challenge of Implementing Reverse Logistics in Social Improvement: The Possibility of Expanding Sovereignty Food in Developing Communities. Maldonado and Moya. Nova Publising. 2013.She published 14 papers in international journals: 14. Indexed national magazines: 4 as: Mariela B. Maldonado, Et al. 2011. "A simple model of the diffusion phenomena taking place during the debittering process of green table olives, 2011. Journal of Fats and Oils. Revista Grasas y Aceites".62 (1), Enero-Marzo, 39-48;Maldonado Mariela y Silvia Moya. 2010. "Posibles mejoras para paliar el hambre mediante el Banco de Alimentos de Mendoza" Revista española de

Nutrición Comunitaria. Vol16. Tomo 2. P98-104. España.Mariela Maldonado y Silvia Moya. 2010. "La logística inversa en la mejora social: Banco de Alimentos de Mendoza, un caso típico". *Mundo Logístico* mayo-junio. Revista especializada en la administración de cadena de suministro en México y Latinoamérica.

Dra. Maldonado Mariela received Honours, Awards And Work For Committees as: Gold Plate And Honor Diploma. Average Prime and Regularity on Studies in Licenciatura en Bromatología. 1996. Uncuyo. Facultad de Ciencias Agrarias. She received a Honorary Mention, Argentinian Federation Of University Women in merit for the best in your graduate. 1997 and shes is Honorary Member of the Centro De Bromatólogos. Mendoza. 1996. She rendered with honors PhD in Biological Sciences UNCUYO.. Resol.18/04-CADAC. 2004. She is a Reviewer arbitrator; Chemical Engineering Journal. 2010; Journal of Chemical Engineering. 2010; Postharvest Biology and Technology. 2010. Elsevier Editorial, International Journal of Dairy Technology. 2011. Journal of Food Processing and Preservation 2012-2013. Renc.2012 Elsevier Science Publishers – Amsterdam. 2013.

Pérez Raúl César

Place of birth: Victoria. Entre Ríos, Argentina. Date of birth: 25th october 1956 *He is Licenciado en Física*. *Graduate Degree.* Facultad de Cs. Físicas, Matemáticas y Naturales. Universidad Nacional de San Luis. Thesis: *"Diagonalizated Complex Matrix".* And obteneided a PhD: *Doctorado en Ingeniería*. *Postgraduate Degree*. Thesis:*"Validation of the conceptual pattern of Antihail Fight with airplanes. Efficiency Index of Seeding (EIS)".* Facultad de Ingeniería. Universidad Nacional de Cuyo. Mendoza. Argentina and has a *Master of Education, and Computer Psychic.* Facultad de Cs. Humanas de la Universidad Nacional de San Luis in agreement with Universidad Nacional de Lomas de Zamora.

He has a solid academic university training. He won more than 25 teaching positions by contest. The most related with this article are: Enclosed Professor in Algebra and Analytic Geometry with simple dedication in the career of Electromechanical Engineering in Universidad Tecnológica Nacional (UTN), Facultad Regional Mendoza, annexed Rivadavia. Since 1998 until 2005. Enclosed Professor in Physics II with simple dedication in the career of Electromechanical Engineering in Universidad Tecnológica Nacional (UTN), Facultad Regional Mendoza, annexed Rivadavia. 2003. Professor of Physical in the career of Tecnicatura Universitaria en Higiene y Seguridad Industrial. Universidad Tecnológica Nacional (UTN). Facultad Regional Mendoza. Virtual Studied. 2007an continue. He is author and reviewer of the following magazines:Continental Journal of Applied Sciences. (ISSN: 1597 - 9928) Continental Journal of Water, Air, and Soil Pollution.

Continental Journal of Sustainable Development. Continental Journal of Earth Sciences. Continental Journal of Food Science and Technology (ISSN: 2141 - 422X).

Dr Raúl Pérez has received a First Competition in Risk and Sure Agricultural: Fisrt special Mention for Resolution 572/2005 (B.O. 30.697. 18th July 2005) of the Secretary of Agriculture, Cattle raising, Fishes and Foods of the Nation.And he is a member ship Member of the European Union of Geosciences (EGU). Since 2004. Member of the International Association for Professional Congress Organizers (IAPCO). Since 2011.Member of the World Environment Journal**.** Since 2012.