Package 'PUPMSI'

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Type Package

Title Moisture Sorption Isotherm Modeling Program

Version 0.1.0

Description Contains sixteen moisture sorption isotherm models, which evaluate the fitness of adsorption and desorption curves for further understanding of the relationship between moisture content and water activity. Fitness evaluation is conducted through parameter estimation and error analysis. Moreover, graphical representation, hysteresis area estimation, and isotherm classification through the equation of Blahovec & Yanniotis (2009) <doi:10.1016/j.jfoodeng.2008.08.007> which is based on the classification system introduced by Brunauer et. al. (1940) <doi:10.1021/ja01864a025> are also included for the visualization of models and hysteresis.

License GPL-2

Encoding UTF-8

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Imports ggplot2, Metrics, minpack.lm, nls2, stats

NeedsCompilation no

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Contents

`BETMSI` *Brunauer-Emmett-Teller(BET) Moisture Sorption Isotherm*

Description

Brunauer-Emmett-Teller(BET) is a two-parameter isotherm model used for the optimum moisture content determination for drying and storage stability of foods, and in the food's surface area estimation.

Usage

```
BETMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Brunauer-Emmett-Teller(BET) Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Aviara, N. A., et al. (2016). Effect of Temperature and Moisture Sorption Hysteresis on Monolayer Moisture Content of Selected Crops Determined Using BET and GAB Models. 37Th Annual Conference and Annual General Meeting-"Minna 2016," October.

Staudt, P. B., et al. (2013) <doi:10.1016/j.jfoodeng.2012.07.016> A new method for predicting sorption isotherms at different temperatures using the BET model. Journal of Food Engineering, 114(1), 139-145.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
BETMSI(WaterAct, AdsorpM, DesorpM)
```

BradleyMSI *Bradley Moisture Sorption Isotherm*

Description

Bradley model is a two-parameter isotherm model that measures polar nature of sorptive surfaces.

Usage

```
BradleyMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Bradley Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Bradley, R. Stevenson (1936) <doi:10.1039/JR9360001467> Polymolecular adsorbed films. Part I. The adsorption of argon on salt crystals at low temperatures, and the determination of surface fields. Journal of the Chemical Society (Resumed), (), 1467-.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
BradleyMSI(WaterAct, AdsorpM, DesorpM)
```

CaurieMSI *Caurie Moisture Sorption Isotherm*

Description

Caurie model is a two-parameter isotherm created for calculation of water sorption data of dehydrated foods over a wide range of water activity.

Usage

```
CaurieMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Caurie Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Caurie, M. (1970) <doi:10.1111/j.1365-2621.1970.tb01571.x> A new model equation for predicting safe storage moisture levels for optimum stability of dehydrated foods. International Journal of Food Science & Technology, 5(3), 301-307.

Caurie, M. (2007) <doi:10.1111/j.1365-2621.2006.01203.x> Hysteresis phenomenon in foods. International Journal of Food Science and Technology, 42(1), 45-49.

Caurie, M. (2011) <doi:10.1007/978-90-481-3585-1_71> Hysteresis in foods. In Encyclopedia of Earth Sciences Series: Vol. Part 4 (p. 384). Springer Netherlands.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
CaurieMSI(WaterAct, AdsorpM, DesorpM)
```

GABMSI *Guggenheim-Anderson-de Boer(GAB) Moisture Sorption Isotherm*

Description

GAB model is a multimolecular, localized and homogeneous adsorption model, is one of the most versatile models considering multilayer adsorption at high water activity values.

Usage

```
GABMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Guggenheim-Anderson-de Boer(GAB) Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Aviara, N. A. (2020) <doi:10.5772/intechopen.87996> Moisture Sorption Isotherms and Isotherm Model Performance Evaluation for Food and Agricultural Products. In Sorption in 2020s. IntechOpen.

Aviara, N. A., et al. (2016). Effect of Temperature and Moisture Sorption Hysteresis on Monolayer Moisture Content of Selected Crops Determined Using BET and GAB Models. 37Th Annual Conference and Annual General Meeting-"Minna 2016," October.

Maroulis, Z. B., et al. (1988) <doi:10.1016/0260-8774(88)90069-6> Application of the GAB model to the moisture sorption isotherms for dried fruits. Journal of Food Engineering, 7(1), 63-78.

Prasantha, B. D. R. (2018). Prediction of Moisture Adsorption Characteristics of Dehydrated Fruits Using the GAB. Ann Agric Crop Sci, 3(1), 1-4.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
GABMSI(WaterAct, AdsorpM, DesorpM)
```

HailHorroMSI *Hailwood-Horrobin (HH) Moisture Sorption Isotherm*

Description

Hailwood-Horrobin (HH) model is an example of multilayer surface sorption model, is suitable for analysis of experimental wood moisture sorption (WMS) isotherms.

Usage

```
HailHorroMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Hailwood-Horrobin (HH) Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Hailwood, A. J., & Horrobin, S. (1946) <doi:10.1039/TF946420B084> Absorption of water by polymers: Analysis in terms of a simple model. Transactions of the Faraday Society, 42(0), B084-B092.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
HailHorroMSI(WaterAct, AdsorpM, DesorpM)
```

HalseyMSI *Halsey Moisture Sorption Isotherm*

Description

Halsey Isotherm is a 2-parameter model which expresses condensation of multilayers at proportionally large distances from the surface considering the assumption that a molecule's potential energy is inversely proportional to the nth power of its distance from the surface.

Usage

```
HalseyMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Halsey Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Halsey, G. (1948) <doi:10.1063/1.1746689> Physical adsorption on non-uniform surfaces. The Journal of Chemical Physics, 16(10), 931-937.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
HalseyMSI(WaterAct, AdsorpM, DesorpM)
```

HendersonMSI *Henderson Moisture Sorption Isotherm*

Description

Henderson Isotherm is an empirical two-parameter equation for moisture adsorption of food products, useful in predicting moisture content for different water activity levels.

Usage

```
HendersonMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Henderson Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Stencl, J. (2004) <doi:10.1260/0263617042863039> Moisture Sorption Isotherms of Whey Powder Spray in the 10-40C Temperature Range. Adsorption Science & Technology, 22(5), 377-384.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
HendersonMSI(WaterAct, AdsorpM, DesorpM)
```

HysteresisMSI *Hysteresis Area, Brunauer Classification System*

Description

Hysteresis area evaluation via trapezoidal approximation.

Usage

```
HysteresisMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

WaterAct	the numerical value of Water Activity, which ranges from 0 to 1.
AdsorpM	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
DesorpM	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the measurement of hysteresis, classification of isotherms, and graphical visualization for the observed values of moisture sorption isotherms.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Caurie, M. (2007) <doi:10.1111/j.1365-2621.2006.01203.x> Hysteresis phenomenon in foods. International Journal of Food Science and Technology, 42(1), 45-49.

Brunauer, S., et al. (1940) <doi:10.1021/ja01864a025> On a Theory of the van der Waals Adsorption of Gases. Journal of the American Chemical Society, 62(7), 1723-1732.

Blahovec J., & Yanniotis S. (2009) <doi:10.1016/j.jfoodeng.2008.08.007> Modified classification of sorption isotherms. J Food Eng. 2009 Mar; 91 (1): 72-77

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
HysteresisMSI(WaterAct, AdsorpM, DesorpM)
```

IgleChiMSI *Iglesias-Chirife Moisture Sorption Isotherm*

Description

Iglesias-Chirife Isotherm is an an empirical equation for describing water sorption behavior of various fruits and other sugar-rich foods.

Usage

```
IgleChiMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Iglesias-Chirife Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Chirife, J., & Iglesias, H. A. (1978) <doi:10.1111/j.1365-2621.1978.tb00792.x> Equations for fitting water sorption isotherms of foods: Part 1 - A review. International Journal of Food Science & Technology, 13(3), 159-174.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
IgleChiMSI(WaterAct, AdsorpM, DesorpM)
```

KuhnMSI *Kuhn Moisture Sorption Isotherm*

Description

Kuhn Isotherm is a two-parameter model which contains many defining characteristics wherein each surface site has a different adsorption potential, as well as cluster formations on each site due to increase in partial pressure.

Usage

```
KuhnMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Kuhn Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Bi, Y., et al. (2018). The prediction of moisture adsorption isotherm for commercial sodium bicarbonate powder. International Journal of Scientific & Engineering Research, 9(3).

Kuhn, I. (1967) <doi:10.1016/0021-9797(67)90202-0> A generalized potential theory of adsorption. I. The derivation of a general equation for adsorption isotherms. Journal of Colloid And Interface Science, 23(4), 563-571.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
KuhnMSI(WaterAct, AdsorpM, DesorpM)
```

LangmuirMSI *Langmuir Moisture Sorption Isotherm*

Description

Langmuir Isotherm is a two-parameter model applicable for unimolecular layers with similar sorption sites. Langmuir's isotherm is the most crucial equation among the theoretical models, whose basis are the forces acting between the product surface and the condensed water from the vapor as a monomolecular layer.

Usage

```
LangmuirMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Langmuir Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Andrade, R. D., et al. (2011). Models of sorption isotherms for food: Uses and limitations. Vitae. In Vitae (Vol. 18, Issue 3). Facultad De Qui??mica Farmace??utica, Universidad de Antioquia. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-40042011000300012&lng=en&nrm=iso&tlng=en

Saroyda, J. V., Cruz, et al. (2020) <doi:10.1016/S0001-8686(00)00082> Package "PUPAIM" Type Package Title A Collection of Physical and Chemical Adsorption Isotherm Models Version 0.2.0. <doi:10.1016/S0001-8686(00)00082>

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
LangmuirMSI(WaterAct, AdsorpM, DesorpM)
```

Lewicki2MSI *Lewicki-2-Parameter Moisture Sorption Isotherm*

Description

Lewicki-2-Parameter MSI is a two-parameter sorption model that was developed based on Raoult's law, which assumes that water is present either as free water or as water of hydration.

Usage

```
Lewicki2MSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for Lewicki-2-Parameter model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Lewicki, P. P. (2000) <doi:10.1016/S0260-8774(99)00130-2> Raoult's law based food water sorption isotherm. Journal of Food Engineering, 43(1), 31-40.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
Lewicki2MSI(WaterAct, AdsorpM, DesorpM)
```

Lewicki3MSI *Lewicki-3-Parameter Moisture Sorption Isotherm*

Description

The three-parameter Lewicki model is most suitable for describing the sorption characteristics of raw potato, potato starch, starch-sugar and starch-salt gels within specific temperature and water activity ranges.

Usage

```
Lewicki3MSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for Lewicki-3-Parameter model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

McMinn, W. A., et al. (2004) <doi:10.1002/jsfa.1866> Assessment of two- and three-parameter Lewicki models for description of sorption phenomena of starch materials. Journal of the Science of Food and Agriculture, 84(13), 1695-1700.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
Lewicki3MSI(WaterAct, AdsorpM, DesorpM)
```

ModChenMSI *Modified Chen Moisture Sorption Isotherm*

Description

Modified Chen is 2-parameter model related to the drying principle. It is restricted to situations where diffusion is the primary mode of mass transport and is focused on the steady state of the drying equation.

Usage

```
ModChenMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Modified Chen Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Chen, C. (2019) <doi:10.3390/foods8060191> Validation of the Component Model for Prediction of Moisture Sorption Isotherms of Two Herbs and other Products. Foods, 8(6), 191.

Chen, C. S. (1971) <doi:10.13031/2013.38421> Equilibrium Moisture Curves for Biological Materials. Transactions of the ASAE, 14(5), 0924-0926.

Chen, C. S. & Clayton, J. T. (1971) <doi:10.13031/2013.38422> The Effect Of Temperature On Sorption Isotherms Of Biological Materials. Transactions of the ASAE, 14(5), 0927-0929.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
ModChenMSI(WaterAct, AdsorpM, DesorpM)
```

OswinMSI *Oswin Moisture Sorption Isotherm*

Description

An empirical model developed through a series of mathematical equations that consists in a series expansion for sigmoidal curves.

Usage

```
OswinMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Oswin Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

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Kim M. Villacorte

Chester C. Deocaris

References

Oswin, C. R. (1946) <doi:10.1002/jctb.5000651216> The kinetics of package life. III. The isotherm. Journal of the Society of Chemical Industry, 65(12), 419-421.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
OswinMSI(WaterAct, AdsorpM, DesorpM)
```

PelegMSI *Peleg Moisture Sorption Isotherm*

Description

Peleg model is an empirical 4-parameter isotherm which describes sigmoidal and non-sigmoidal behavior of isotherm plots.

Usage

```
PelegMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Peleg Moisture Sorption Isotherm model.

Author(s)

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References

Abu-Ghannam, N., & McKenna, B. (1997) <doi:10.1016/S0260-8774(97)00034-4> The application of Peleg's equation to model water absorption during the soaking of red kidney beans (Phaseolus vulgaris L.). Journal of Food Engineering, 32(4), 391-401.

Peleg, M. (1993) <doi:10.1111/j.1745-4530.1993.tb00160.x> Assessment of a semi-empirical four parameter general model for sigmoid moisture sorption isotherms. Journal of Food Process Engineering, 16(1), 21-37.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
PelegMSI(WaterAct, AdsorpM, DesorpM)
```

SmithMSI *Smith Moisture Sorption Isotherm*

Description

Smith MSI is an empirical isotherm model for curve assessment of water sorption of polymers with high molar mass.

Usage

```
SmithMSI(WaterAct, AdsorpM, DesorpM)
```

Arguments

`WaterAct`	the numerical value of Water Activity, which ranges from 0 to 1.
`AdsorpM`	the numerical value of the Moisture content of the Adsorption curve, which ranges from 0 to 1.
`DesorpM`	the numerical value of the Moisture content of the Desorption curve, which ranges from 0 to 1.

Value

the nonlinear regression, parameters, and graphical visualization for the Smith Moisture Sorption Isotherm model.

Author(s)

Benz L. Rivera

John Carlo F. Panganiban

Kim M. Villacorte

Chester C. Deocaris

References

Smith, S. E. (1947) <doi:10.1021/ja01195a053> The Sorption of Water Vapor by High Polymers. Journal of the American Chemical Society, 69(3), 646-651.

Examples

```
WaterAct <- c(0.1145,0.2274,0.3265,0.4291,0.6342,0.7385,0.8274,0.9573)
AdsorpM <- c(0.0234, 0.0366, 0.0496, 0.0648, 0.0887, 0.1096, 0.1343, 0.1938)
DesorpM <- c(0.0459, 0.0637, 0.0794, 0.0884, 0.1158, 0.1298,0.1500, 0.1938)
SmithMSI(WaterAct, AdsorpM, DesorpM)
```

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