Modeling and thermodynamic analysis of the water sorption isotherms of cottonseed products

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Supplemental materials

Table S1. Salts and the water activities (a_w) of their saturated salt solutions at different temperatures.

Table S2. The results of two-factor ANOVA with replication (n=2).

Table S3. The six sorption isotherm models better fitting the experimental data of defatted cottonseed products.

Figure S1. Apparatus illustration for the sorption isotherm measurement.

References cited in Table 1S.

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2. Taitano, L.; Singh, R.; Lee, J.; Kong, F. Thermodynamic analysis of moisture adsorption isotherms of raw and blanched almonds. *J. Food Process Engineer.* **2012**, *35*, 840-850.
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Table S1. Salts and the water activities (a_w) of their saturated salt solutions at different temperatures. Data adapted from literature [1-3].

Salt	a_w at 15°C	a_w at 25°C	a_w at 35°C	a_w at 45°C
LiCl	0.1130	0.1130	0.1125	0.1116
$MgCl_2$	0.3330	0.3278	0.3205	0.3110
K_2CO_3	0.4315	0.4316	0.4320	0.4320
$Mg(NO_3)_2$	0.5587	0.5289	0.4991	0.4693
KI	0.7098	0.6886	0.6696	0.6526
NaCl	0.7561	0.7529	0.7487	0.7452
$(NH_4)_2SO_4$	0.8170	0.8099	0.8027	0.7956
KCl	0.8592	0.8434	0.8295	0.8174

Table S2. The results of two-factor ANOVA with replication (n=2)

(A) Defatted cottonseed meal

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Temperature	2425.35599	7	346.4794	2433.172	9.28E-42	2.312741
Saturated salt solution	326.5834574	3	108.8612	764.4837	7.58E-30	2.90112
Interaction (Temperature X salt)	126.9758515	21	6.046469	42.46168	1.04E-17	1.895706
Within	4.556744284	32	0.142398			
Total	2883.472043	63				

(B) water washed defatted cottonseed meal

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Temperature	1113.824403	7	159.1178	244.9574	6.15E-26	2.312741
Saturated salt solution	110.256177	3	36.75206	56.57876	6.84E-13	2.90112
Interaction (Temperature X salt)	10.63220031	21	0.506295	0.779427	0.721661	1.895706
Within	20.78634783	32	0.649573			
Total	1255.499128	63				

(C) Cottonseed protein isolate

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Temperature	997.9564301	7	142.5652	2033.425	1.63E-40	2.312741
Saturated salt solution	138.6405124	3	46.2135	659.1488	7.84E-29	2.90112
Interaction (Temperature X salt)	9.075213836	21	0.432153	6.163851	2.67E-06	1.895706
Within	2.243548379	32	0.070111			
Total	1147.915705	63				

Table S3. The six sorption isotherm models better fitting the experimental data of defatted cottonseed products

Name of model	Equation
B.E.T.	$\frac{a_w}{(1-a_w)M} = \frac{1}{M_m C} + \frac{a_w(C-1)}{M_m C}$
Bradley	$\ln\left(\frac{1}{a_w}\right) = K_2 K_1{}^M$
G.A.B.	$M = \frac{M_0 C K a_w}{(1-K a_w)(1-K a_w + C K a_w)}$
Halsey	$a_w = e^{-\frac{a''}{M^r}}$
Henderson	$\ln[-\ln(1-a_w)] = n \cdot \ln M + \ln k$
Oswin	$M = a\left(\frac{a_w}{1-a_w}\right)^n$

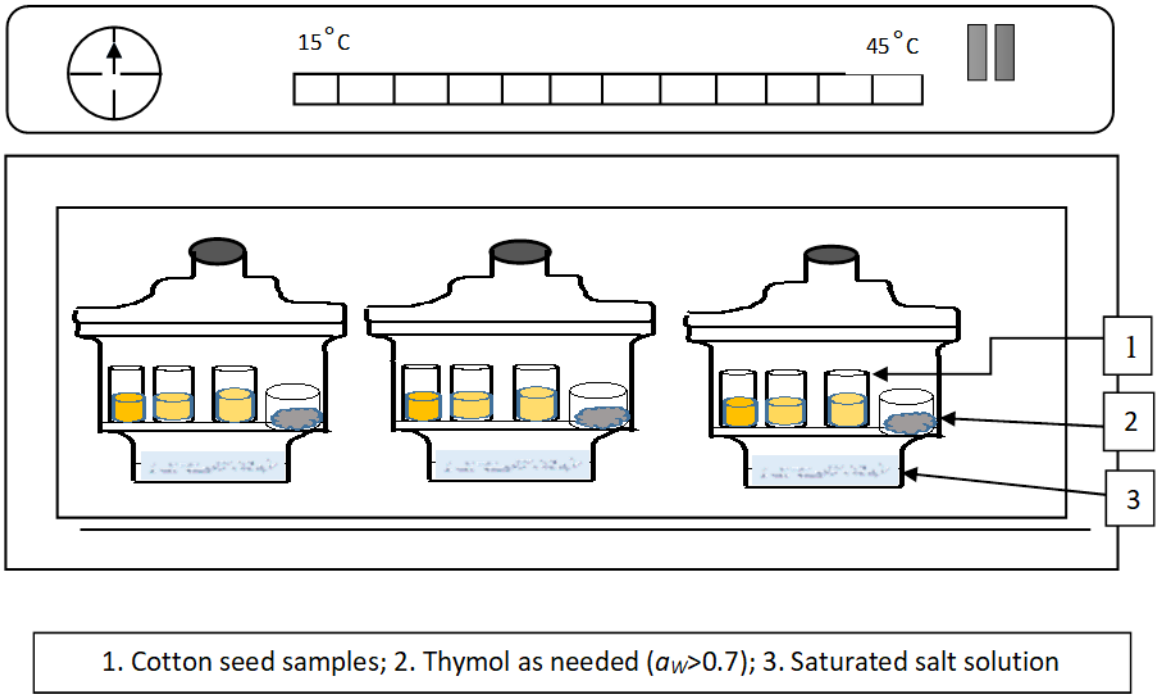

Figure S1. Apparatus illustration for the sorption isotherm measurement.