

Alkaline fractionation of rice husk, and subsequent production of nano-structured silica and cellulose nano-fibrils for the comprehensive utilization of fractionation residues

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Run No.	X ₁	X ₂	X ₃	xmg extraction yield (%)		De-ashing yield (%)	
				Experimental	Predicted	Experimental	Predicted
1	130	20	2.0	21.73	19.07	85.94	81.05
2	170	20	2.0	32.27	33.40	86.88	83.51
3	130	60	2.0	22.53	25.09	86.03	84.12
4	170	60	2.0	32.65	30.69	87.59	86.16
5	130	20	5.0	52.69	56.21	92.24	91.24
6	170	20	5.0	60.27	59.17	94.72	94.20
7	130	60	5.0	57.20	57.55	94.35	95.29
8	170	60	5.0	47.70	51.78	95.39	97.85
9	116	40	3.5	29.76	28.22	88.88	91.78
10	184	40	3.5	35.87	35.41	95.47	95.99
11	150	6	3.5	45.17	45.39	82.83	87.46
12	150	74	3.5	46.48	44.24	94.32	93.10
13	150	40	1.0	23.81	25.08	69.22	74.93
14	150	40	6.0	77.39	74.05	95.62	93.32
15	150	40	3.5	48.36	49.35	93.36	93.65
16	150	40	3.5	49.77	49.35	93.88	93.65
17	150	40	3.5	49.49	49.35	94.31	93.65

Figure S1. Central composite experimental design and responses obtained for the alkaline fractionation of rice husk on the yields of xmg extraction and de-ashing: X1: reaction temperature (°C); X2: reaction time (min.); X3: NaOH concentration (wt.%).

	xmg extraction			De-ashing		
	Sum of Squares	F value	P value	Sum of Squares	F value	P value
Model	3550.50	38.71	<0.0001	613.28	4.00	0.0406
X ₁	62.43	6.13	0.0425	21.42	1.26	0.292
X ₂	1.60	0.16	0.7038	38.41	2.25	0.1769
X ₃	2894.01	283.95	<0.0001	408.15	23.95	0.0018
X ₁ X ₂	38.11	3.74	0.0944	0.084	4.933 x 10 ⁻³	0.9460
X ₁ X ₃	64.64	6.34	0.0399	0.13	7.633 x 10 ⁻³	0.9328
X ₂ X ₃	10.90	1.07	0.3354	0.419	0.029	0.8701
X ₁ ²	433.33	42.52	0.0003	0.077	4.544 x 10 ⁻³	0.9481
X ₂ ²	28.99	2.84	0.1355	15.96	0.94	0.3653
X ₃ ²	0.065	6.340E-003	0.9388	127.73	7.50	0.0290
Residual	71.34			119.27		
Lack of fit	70.26	25.86	0.0376	118.82	105.01	0.0095
Pure error	1.09			0.45		
Cor Total	3621.85			732.55		

Figure S2. Analysis of variance (ANOVA) for the adjusted quadratic model for alkaline fractionation of rice husk on the xmg extraction yield and de-ashing yield.

X₁: reaction temperature; X₂: reaction time; X₃: NaOH concentration

For xmg extraction: Std. Dev. = 3.19, C.V = 7.40, Mean = 43.14, PRESS = 591.03, R² = 0.9803.

Precision-adeq = 22.450, R²adj = 0.9550, R²pred = 0.8368.

For de-ashing: Std. Dev. = 4.13, C.V = 4.58, Mean = 90.06, PRESS = 903.49, R² = 0.8372.

Precision-adeq = 7.237, R²adj = 0.6278, R²pred = -0.2333.