CHAPTER FOUR

Results and Discussion

4.1 Result

The result obtained from the testing of the fabricated hybrid dryer for cocoa bean were presented in table 4.1 below.

Table 4.1: Summary of Result of Cocoa Drying Using the Fabricated Hybrid Solar Dryer

Run	Mass of Sample (g)	Air Flow Rate (kg/h)	Drying Rate (kg/h)	Drying Efficiency (%)
1	1000	0.6	0.042	78.3
2	2000	0.5	0.033	87.6
3	2000	0.5	0.033	87.6
4	2000	0.4	0.029	91.2
5	3000	0.6	0.031	89.2
6	3000	0.4	0.024	96.3
7	2000	0.5	0.034	86.1
8	1000	0.4	0.035	85.4
9	2000	0.5	0.031	89.2
10	1000	0.5	0.037	83.9
11	2000	0.5	0.033	87.6
12	3000	0.5	0.027	92.8
13	2000	0.6	0.036	84.1

4.2 Discussion

The results obtained from testing the hybrid dryer were presented in table 4.1 above. From the

table, it was observed that different mass of sample and airflow rate gave different drying rate and drying efficiency respectively. It was also observed that an increase in mass of sample at the same air flow rate gave a decrease in the drying rate and drying efficiency while an increase in the air flow rate at the same mass of sample gave an increase in drying rate and drying efficiency. This could be attributed to the ease of moisture migration within the sample at higher air flow rate. The analysis of variance (ANOVA) for the drying rate and drying efficiency of cocoa bean is presented in table 4.2 and 4.3 below respectively.

Table 4.2: Analysis of Variance (ANOVA) for the Drying Rate of Cocoa Bean

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0002	2	0.0001	184.90	< 0.0001	significant
A-Mass of Sample	0.0002	1	0.0002	258.49	< 0.0001	
B-Air Flow Rate	0.0001	1	0.0001	111.32	< 0.0001	
Residual	6.603E-06	10	6.603E-07			
Lack of Fit	1.803E-06	6	3.004E-07	0.2504	0.9353	not significant
Pure Error	4.800E-06	4	1.200E-06			

Cor Total	0.0003	12				

***Significant @P≤0.05**

From table 4.2 above, the p value < 0.0001 shows that the model is significant being far below 0.05. this indicates that the selected factors of mass of sample and air flow rates have a great effect on the drying rate of cocoa bean. The graphical representation is shown in figure 4.1 below.

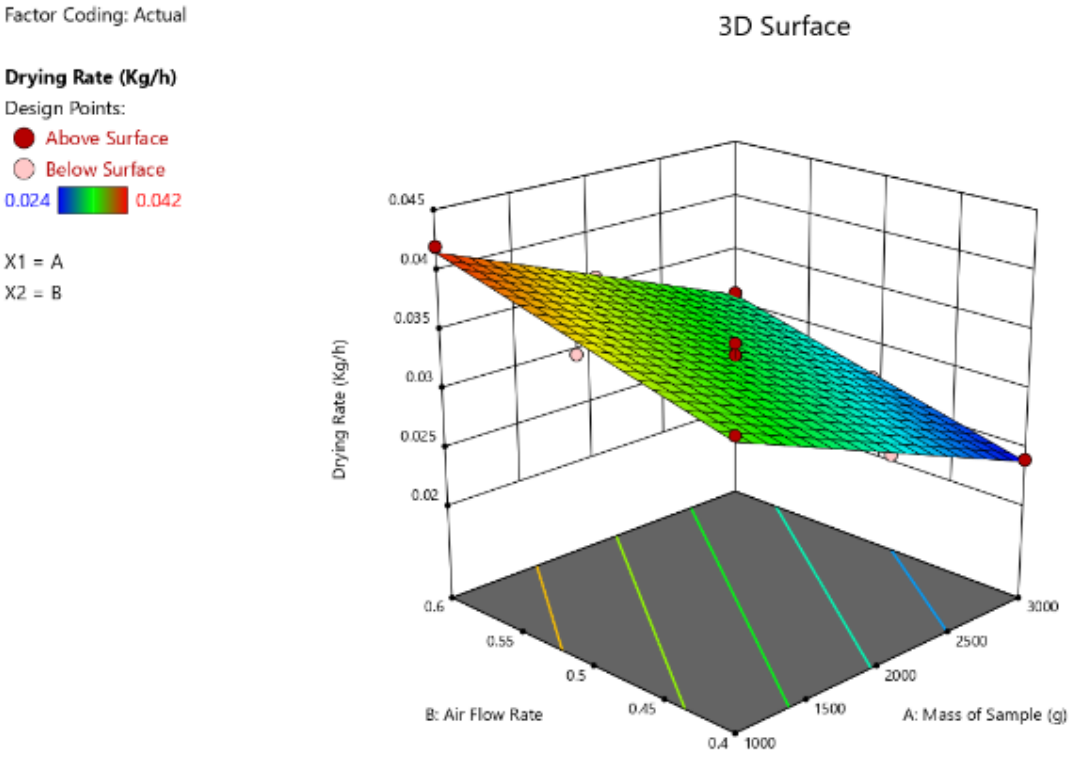

Fig 4.1: Effect of Air Flow Rate and Mass of Sample on the Drying Rate of Cocoa

Table 4.3: Analysis of Variance (ANOVA) for the Drying Efficiency of Cocoa Bean

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	232.70	2	116.35	152.81	< 0.0001	Significant
A-Mass of Sample	157.08	1	157.08	206.30	< 0.0001	
B-Air Flow Rate	75.62	1	75.62	99.31	< 0.0001	
Residual	7.61	10	0.7614			
Lack of Fit	2.81	6	0.4677	0.3891	0.8551	not significant
Pure Error	4.81	4	1.20			
Cor Total	240.31	12				

***Significant @P≤0.05**

From table 4.3 above, the p value < 0.0001 shows that the model is significant being far below 0.05. this indicates that the selected factors of mass of sample and air flow rates have a great

effect on the drying efficiency of cocoa bean. The graphical representation is shown in figure 4.2 below.

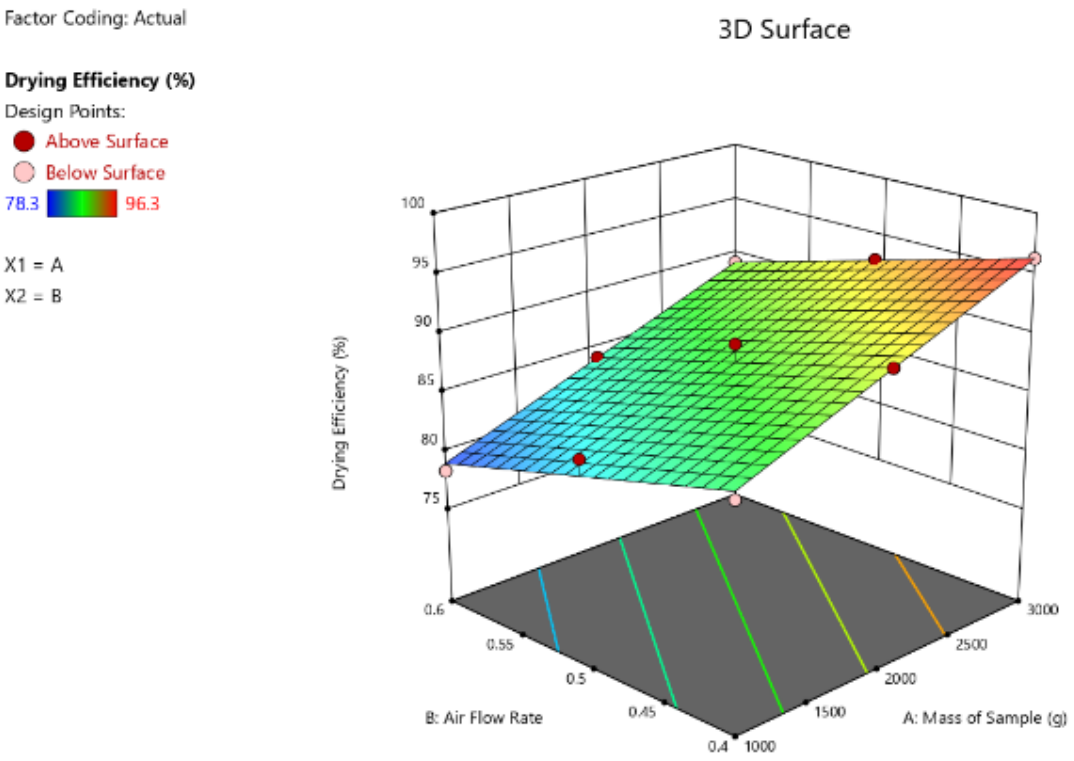

Fig 4.2: Effect of Air Flow Rate and Mass of Sample on the Drying Efficiency of Cocoa