Quality Control of Impregnated Papers with a Multiple Regression Model

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ABSTRACT
The company M.Kaindl produces at its plant in Salzburg, urea – and melamine formaldehyde impregnated papers, as a basic raw material for the lamination of particle boards. To guarantee high and consistent product quality, different sensors and processing technologies for process and quality control are required. This publication deals with the analysis and the modeling of the essential material and process parameters considering their influence on the essential output parameters basis weight and moisture content (MC) of the impregnated papers.

1 INTRODUCTION

The findings of [1] show the importance of constant properties of impregnated papers and in [2] different models for quality control are compared. These findings are a basis for the work shown here.

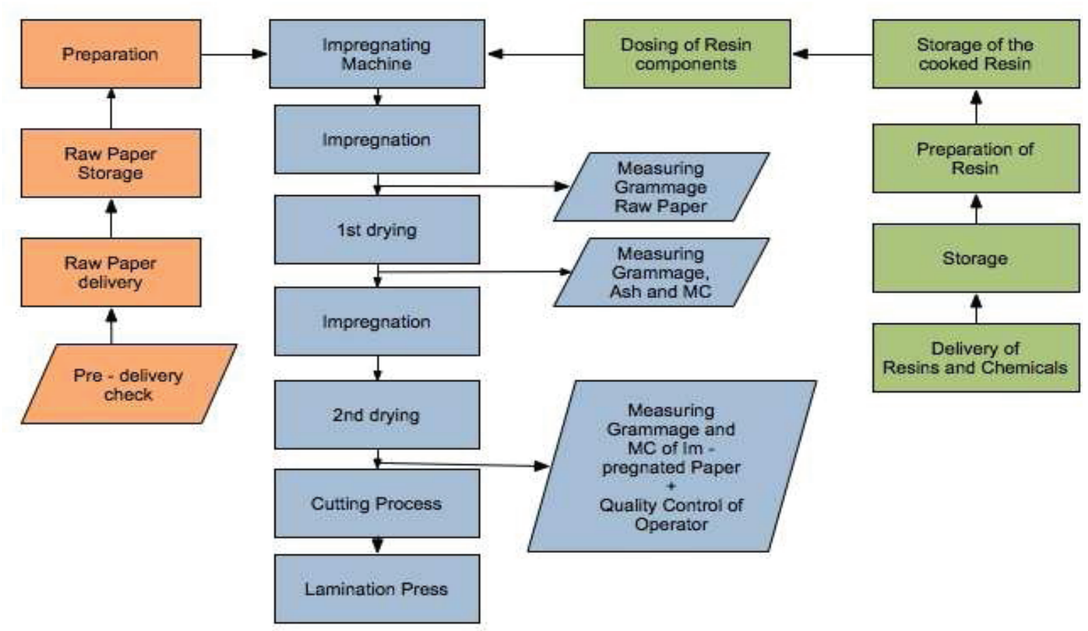

Figure 1: Process chart of Impregnated paper production

The production of impregnated papers is done according to the process chart in Figure 1. The raw paper control and processing is shown in orange color, the resin and chemicals control and processing is shown in green color and the film production processes and control systems are shown in blue color.

Within this project the question, whether it is possible to improve the accuracy of the existing measurement system by predicting the output parameter using a multiple regression model or not, is answered.

2 METHODS AND RESULTS

The modeling was done in two steps. In the first step data were collected over a time period of six weeks during the current production process. In this process automated measureable data were collected in the facility and additional data from possible predictors, which have been analyzed in a laboratory, were also collected.

3 RESULTS

On the basis of the collected data, predictors that were statistically significant were identified using multiple linear regression analysis.

In the second step the determined significant output parameters were collected over a time period of six weeks and a multiple linear regression (MLR) model to verify the results of the first experimental model was developed. For the MLR models only automated statistically significant parameters were used to ensure a high and steady quality of the final product. In Figure 2 the improvements in quality control are shown for the two optimized models. In Table 1 all model parameters are shown, as well as the model summary.

	Model 1				Model 2			
	Model Parameters				Model Parameters			
	B	Std Err	t	Sig	B	Std Err	t	Sig
Constant	7,084	0,51	12,19	,000	5,257	0,25	20,623	,000
b1	0,046	0,006	7,588	,000	-0,007	0,001	-5,441	,000
b2	-0,029	0,003	-8,875	,000	,033	0,003	10,466	,000
b3	-0,73	0,022	-3,265	,002	-0,04	0,019	-2,128	,035
b4	-0,008	0,001	7,546	,000				
	Model Summary				Model Summary			
R	0,92				0,786			
R2	0,851				0,618			
Adj. R2	0,838				0,610			
Std Err. of Estimates	0,16926				0,34261			

Table 1: Model Parameters and Model Summary of the two Models

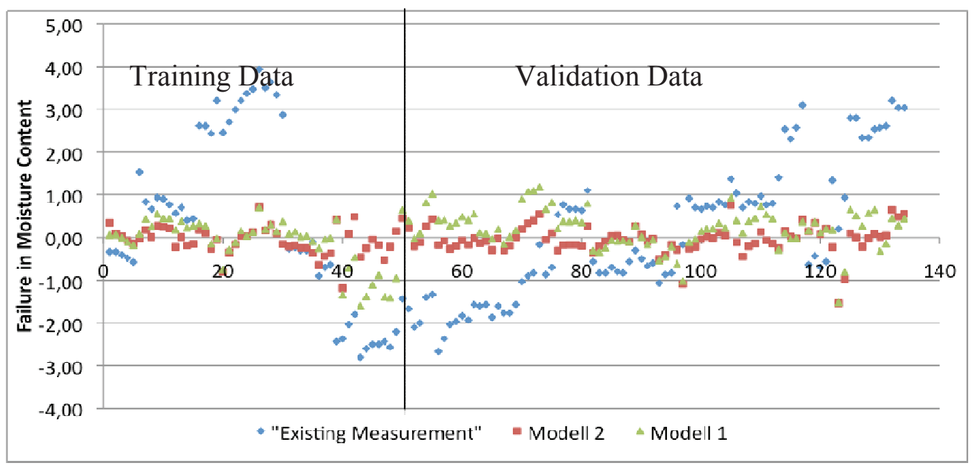

Figure 2: Improvements in Quality control

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