Optimalisatie van het dry forming proces bij Trespa International BV : een onderzoek met betrekking tot afvalstromen en energiegebruik

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Optimalisatie van het *Dry Forming* Proces bij Trespa International BV

Een onderzoek met betrekking tot afvalstromen en energiegebruik

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Voorwoord

In het kader van de Studie Technische Bedrijfskunde aan de Technische Universiteit Eindhoven is dit afstudeeronderzoek uitgevoerd.

Ik wil alle medewerkers van Trespa International BV in Weert bedanken. Behalve hun bijdrage aan dit verslag hebben ze van mijn stage een prettige en leerzame tijd gemaakt.

Mijn speciale dank gaat uit naar mijn begeleiders van de universiteit, Maarten Splinter en Johan Wijers en mijn begeleider bij het bedrijf, Ruud Scholtes.

Sterksel, april 2000

Erik Dupree

"Better to remain silent and be thought a fool than to speak out and remove all doubt."
(Abraham Lincoln)

Abstract

In this report, the dry forming process at Trespa International is being investigated in respect to waste streams and energy consumption. Based on the investigation, most promising areas for optimisation are identified.
Outcome of the project are alternative scenario's for wastewater treatment and reuse, which have been evaluated on technical, economical, and environmental aspects.

Summary

A description of Trespa International BV

Trespa International BV is an international company, which develops and produces panels. These panels are mainly used for façade cladding, interior finishing and industrial furniture.
Trespa-panels are panels of thermosetting resins, homogeneous reinforced with woodfibre. The panels are build from a core, which is in between of two decorsheets. The panels are made under high pressure and high temperature.
During the production process of Trespa-panels, the following units can be distinguished:

- production unit core material (PUCM)
- production unit decor material (PUDM)
- production unit panel assembly (PUPA)

Project formulation

During the last years there has been a growing social awareness for environmental aspects. This has had an influence on the industry. Besides continuous strive for better quality of products, the belief has grown that the industry should strive for a better way of production in such a way that negative environmental influences are reduced.
This believe has also grown at Trespa International BV. In connection with this believe, the following project formulation has been formulated:

Optimise the Dry Forming process at Trespa International BV, with respect to wastestreams and energy consumption.

What is the effect of the following future influences.

- Future legislation with respect to industrial emissions and energy consumption
- An increase of the productive capacity of the DF.

The Dry Forming is an part of the PUCM. In the DF, pre-impregnated panels (PrePregs) are produced, which are used as core material in the production of Trespa-panels.

This project has been approached with the aid of a theoretical model. The model used is the Tien-Stappen-Plan. By the direct method of this model the project is divided into tree sequenced phases.

1. The orientation phase
2. The investigation and solution phase
3. The implementation phase

The investigation of the dry forming process

The goal of the investigation of the DF was to have a notion of the product-, waste- and energy flows from the DF process. These flows have been quantified and made visible in a Sankey diagram.

On the basis of the investigation, the flows which have a bulk share in the energy-, material- and disposal costs of the DF have been identified.
The disposal of DF wastewater, which is polluted with phenolic and formaldehyde components, generates the highest costs. It's expected that the disposal of DF wastewater has the most potential for optimisation to lead to a reduction in costs.
Therefore the disposal of DF wastewater has been chosen to be the subject for optimising the DF.

Attacking the wastewater

To reduce the costs of the removal of DF wastewater several approaches can be chosen. The possible approaches are given by the PRISMA model for waste reduction and energy savings.
The PRISMA model has been used to identify several ways to optimise the removal of DF wastewater. These ways for optimisation can be classified into three groups.

1. The first group tries either to reduce the wastewater in quantity or to reduce the degree of pollution of the wastewater by introducing technological changes to the DF production process.
2. The second group tries to reduce the wastewater in quantity or to reduce the degree of pollution of the wastewater by introducing methods for 'Good Housekeeping'.
3. The third group is focused on finding better end-of-pipe alternatives for the disposal of the DF wastewater.

By using the current production technique, PrePregs can be made to satisfy the specifications which have been determined. Implementing new technologies in the DF process can cause negative effects on the quality of the PrePregs. This is an unwanted situation. For this reason it can be undesirable to alter the current DF process.
By introducing better end-of-pipe alternatives for the disposal of wastewater, no changes occur in the current DF process. This means it has no effect on the quality of PrePregs. This also goes for better ways of 'Good Housekeeping'. However it is expected that here is too little potential present for cost reduction.
As a result, it was decided not to focus on group one or group two, but to leave the current DF process unaltered and to search for better end-of-pipe alternatives for the disposal of DF wastewater.

Formulation of scenario's

Out of a great amount of possible end-of-pipe alternatives, the most promising techniques have been determined. On the basis of these techniques, several scenario's for the removal of DF wastewater have been formulated. These scenario's are:

- Current situation. In this scenario no changes are made to the dry forming process.
- Wastewater purification on-site with the use of a Sequenced Batch Reactor (SBR).
- Wastewater purification on-site with the use of a membrane installation. The membrane techniques reverse osmosis and pervaporation have been investigated.

The various scenario's as formulated above are tested for two situation. First the situation where the purified wastewater is lead to the sewer and second the situation where the purified wastewater is used as processwater in the DF process as a substitute for tap water

Evaluation of the scenario's

The scenario's are evaluated on a set of aspects. The following aspects where used:

- Technical aspects;

For the technical evaluation the scenario's are tested on the following aspects:

  - Continuity of the dry forming process
  - Required maintenance and cleaning
  - Required seize of ground
  - Required knowledge

- Economical aspects;

The following economical aspect of the scenario's have been determined:

  - Installation costs
  - Annual costs
  - Net Present Value

- Environmental aspects.

For the environmental evaluation, the scenario's are tested on the following aspect:

  - Influence on the LCA of a Trespa-panel

Conclusions and recommendations

Conclusions

1. The annual costs for the removal of DF waste water, which is polluted with phenol and formaldehyde components, can be reduced. By purifying the wastewater on-site, a decrease in costs can be achieved up to fl. 1.150.000,- per year.
2. The installation costs for the various scenario's diverge from each other in amount. The installation costs for a SBR are fl. 3.500.000,-. For a complete reverse osmosis installation, fl. 683.760,- must be paid.
3. For all of the scenario's holds that the calculated Net Present Value is less negative than the Net Present Value calculated for the present situation. This means that all the scenario's will lead to economical.
4. In the present way the wastewater is handled, the continuity of the Dry Forming can be guaranteed the best.
5. The reviewed scenario's have no influence on the LCA of a Trespa-panel. Despite the fact that the reviewed scenario's have positive environmental influences, these are too small to cause any change in the LCA of a Trespa-panel.

Recommendations

1. Experiments should be started to test DF wastewater purification with the use of a membrane installation. Membrane techniques that should be tested are reverse osmosis and pervaporation.
2. The fact that the installation costs of a SBR are higher as for a membrane installation, and that also the annual costs are higher make the use of a SBR a less attractive option for the purification of DF wastewater.
3. Experiments should be started to test the use of purified DF wastewater as a substitute for tap water, in the dry forming production process.