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COMPLEMENTARY MEASUREMENT OF THE ZETA POTENTIAL OF FIBERS AND THE PARTICLE CHARGE IN PULP SUSPENSIONS WITH THE HELP OF THE AFG TOUCH! TWINS

1. General background

In the paper making process there are fibers, fillers, fines and trash particles (mainly when using recycling paper), suspended in the pulp. Most colloidal or filler particles and fiber surfaces are covered with a negative or positive charge cloud on the surface. Negative and positive charged particles attract each other. Particles with the same charge repel each other. The charge of pulp fibers is anionic (-), also the charge of trash particles is usually anionic (-). Functional chemicals, which are used to determine the quality of the finished product, and process chemicals are mainly cationic (+) charged. Cationic chemicals attract to anionic charged fibers. The knowledge of the charge of the chemicals, the anionic trash and the fibers enables a correct and effective dosage of charged chemical additives.

By measurement of these charges, the CAS *touch!* Charge Analyzing System and the FPA *touch!* Fiber Zeta Potential Analyzer enable the optimization of the dosage of chemicals in the wet-end of the paper manufacturing process. With help of these devices, the optimal adsorption of cationic starch, wet strength resin, and many other chemical aids on the fibers can be easily determined with original samples on-site.

2. Problem I due to anionic trash particles in the pulp suspension

If some cationic chemicals are added in the wet-end process, its reaction is dependent on the status of the trash particles and the previous process steps: The cationic chemicals can stick on the anionic trash particles and/or it can stick on the anionic fibers. If it would stick on the anionic trash, it would neutralize it. The neutralized trash particles would pass through the wire together with the white water and are thus rejected in the waste water. This would additionally result in a higher consumption of flocculation agents for the waste water treatment (see figure 1).

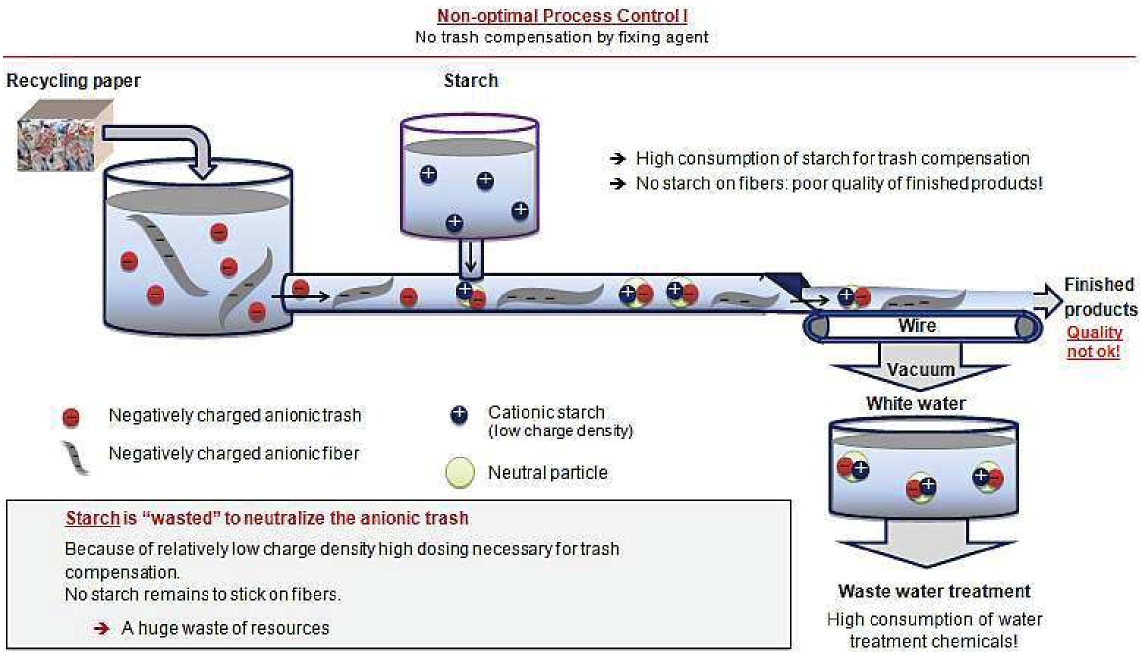

Figure 1: Non-optimal process control I

In order to get the necessary amount of chemicals on the fibers to guarantee a desired quality of the finished products, this would result in additional dosing demand of the paper chemicals (see figure 2).

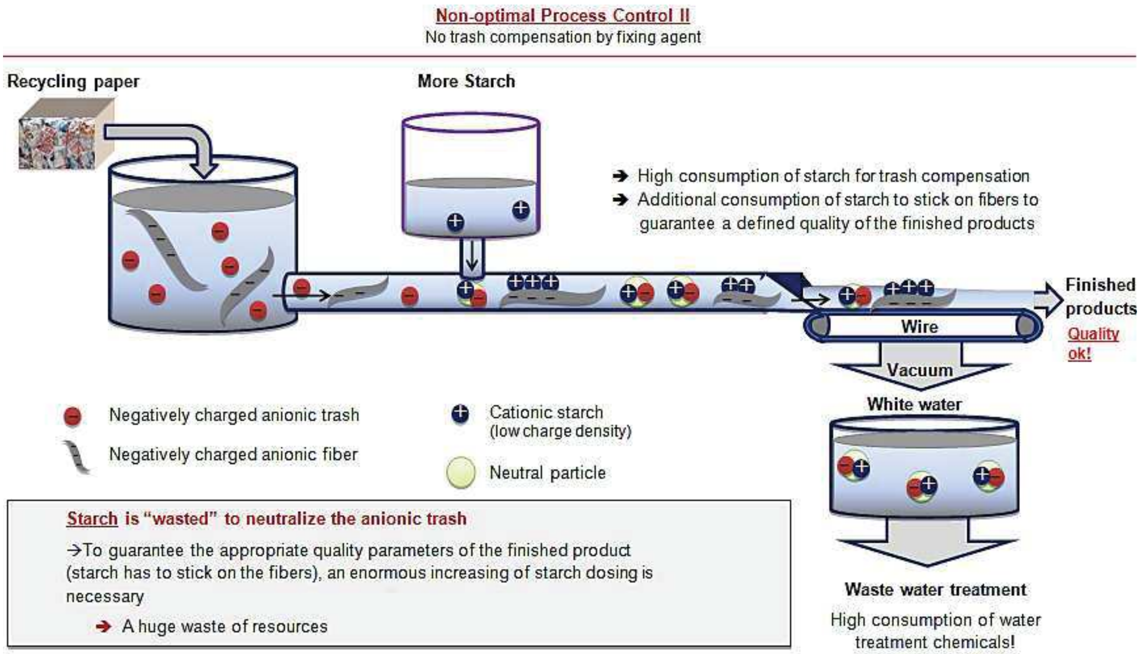

Figure 2: Non-optimal process control II

Solution by use of the CAS *touch!* Charge Analyzing System The main target of CAS measurements is to get information about the amount of anionic trash in the pulp suspension, to determine the optimal dosing of trash catcher/ fixing agent for its neutralization(see figure 3).

The procedure is as follows:

Step 1:Determining the cationic demand with CAS touch!

In the pulp preparation the first step has to be to get information about the amount and charge of the anionic trash. The CAS is used to determine the cationic demand (how much Poly-DADMAC is necessary to neutralize the charge in the CAS measuring cell).

Step 2: Neutralizing the anionic trash for optimal process control and cost saving

For that purpose, anionic trash catcher (ATC) is quite common. ATC has a high affinity to anionic trash particles. It can stick on it and neutralize it. By knowing the cationic demand, the user in the paper mill can calculate the dosing of the trash catcher to neutralize the anionic trash for an optimal process control and cost saving. The costs for trash neutralization with ATC are much lower than for neutralization with paper chemicals like starch, because the charge density of ATC is very high, compared to process chemicals like starch: the price of ATC is in the same range like the price of starch, but because of the much lower consumption of ATC a huge amount of material can be saved.

Step 3:Measurement of the ATC efficiency with CAS

After the neutralization of the anionic trash it is recommended to measure the cationic demand again to check the efficiency of the ATC. The perfect level would be a cationic demand of 0.00ml or at least close to 0.00ml, measured with the CAS. But in a real process it is almost impossible to reach the perfect level. A simple rule is: the neutralization was successful if after the dosage of ATC the cationic demand is lower than 10 % of the previous cationic demand.

Also for the optimization and control of the subsequent dosing points of chemicals the CAS can be used: Under the presumption of optimized trash neutralization the charge demand before and after dosing of chemicals should be similar; because when the chemicals have an optimal reaction in an optimal charge environment, all of them stick on the fibers. The charge demand does almost no change in this case. Another rule of great generality is: the cationic demand should be decreasing from the beginning of the wet-end area up to the last measuring point.

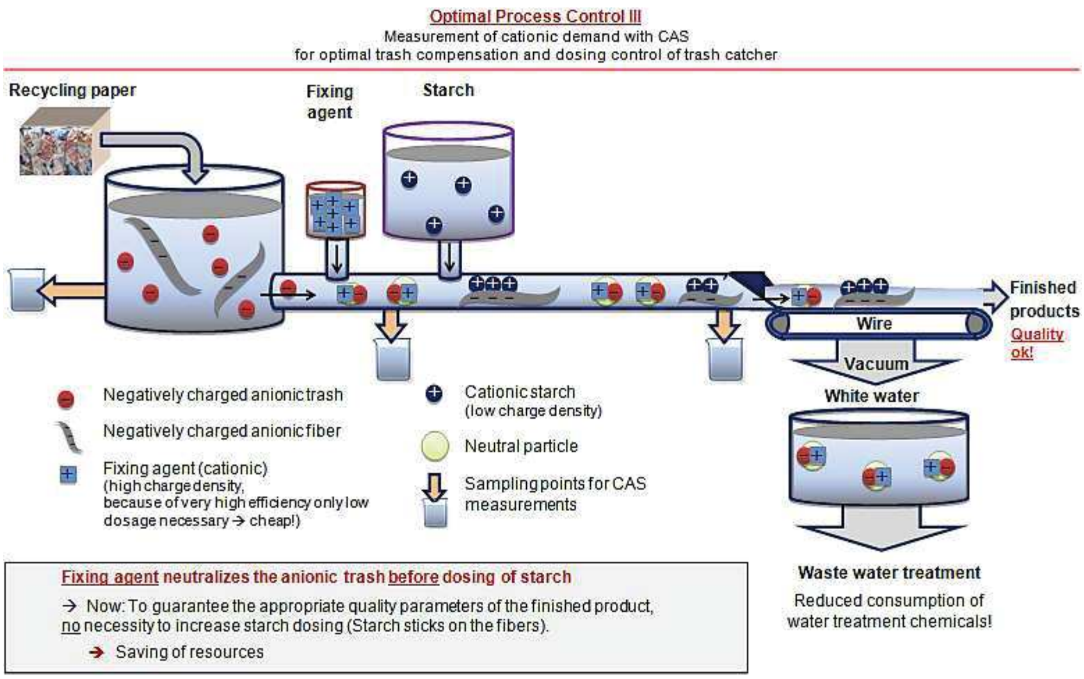

Figure 3: Non-optimal process control III

3. Problem II due to non-optimal Zeta Potential of the fibers

To guarantee optimal quality properties of the finished products (sizing degree, low dusting, strength, stiffness) the dosed chemicals have to stick on the fibers.This reaction is provided mainly by the opposite charge of the chemicals and the fibers. All chemicals, which do not stick on fibers, can pass through the wire and be released together with the white water.

If the trash would be neutralized, but the zeta potential of the fibers would not be optimal, the process and finally the finished products cannot be optimal, because the chemicals will not react with the fibers (see figure 4).

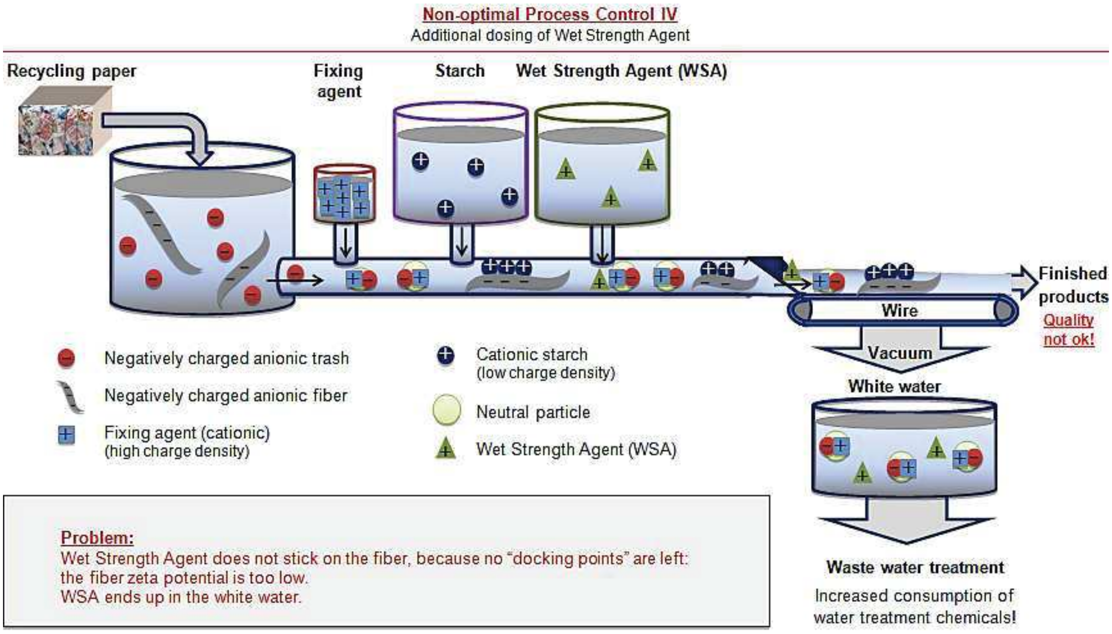

Figure 4: Non-optimal process control IV

Solution by use of the FPA *touch!* Fiber Potential Analyzer

To measure this behavior, the FPA *touch!* is absolutely indispensable. The "Zeta Potential" is the surface charge of fibers. The fibers need a specific value of this Zeta Potential to have enough "space" for the adsorption of the necessary amount of chemicals. The main target of FPA measurements is to get information about the Zeta Potential of fibers for the determination of the optimal reaction of chemicals with the fibers. By knowing and optimizing the Zeta Potential, the targeted quality can be reached (see figure 5).

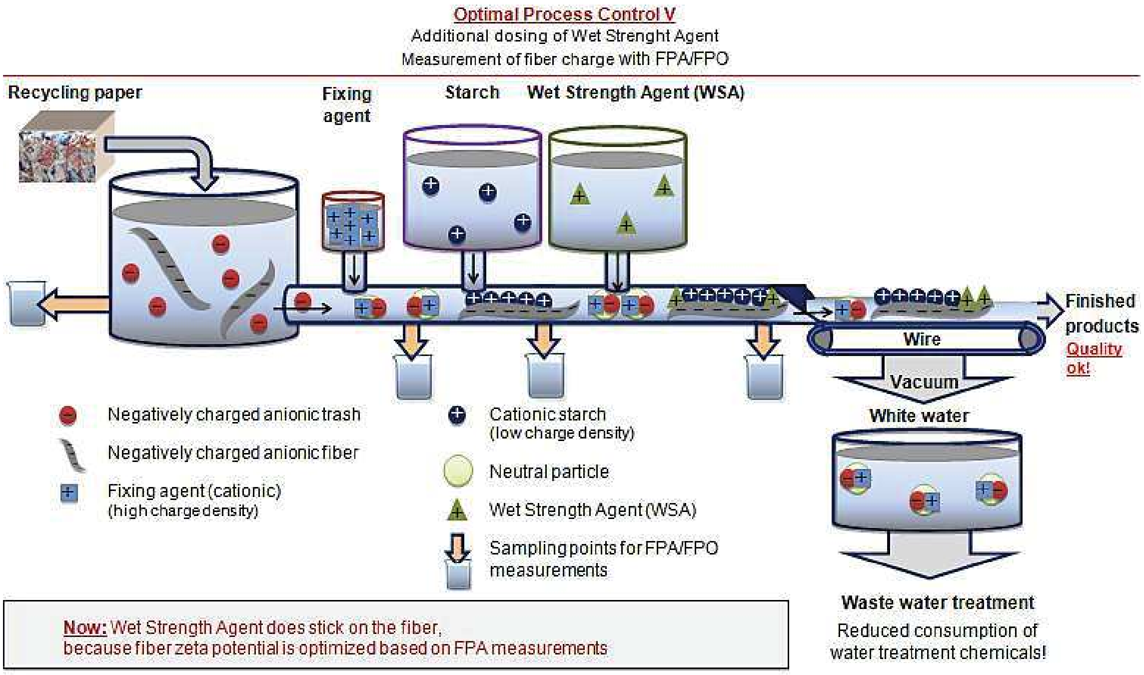

Figure 5: Non-optimal process control V

4. Conclusion

To achieve the targeted quality of the finished products, the dosed chemicals in the wet end should lead to an interaction with the fibers. In particular, they should stick on the fibers because of electro-chemical forces. **The FPA *touch!* is necessary to determine the ability of the fibers to react with the chemicals.** As the cationic chemicals can also stick on the anionic trash particles, **the CAS *touch!* is necessary to determine the optimal dosing of fixing agents and to determine the efficiency of chemicals in the wet-end process.** For an optimal process control, it is absolutely necessary to determine the complete charge environment in the wet-end system, which means measuring with both, the CAS *touch!* and FPA *touch!*.Without the devices, it is impossible to optimize the consumption of chemicals. In this case the guarantee of desired properties of the finished products is only possible by overdosing.