

Ozone stage Z

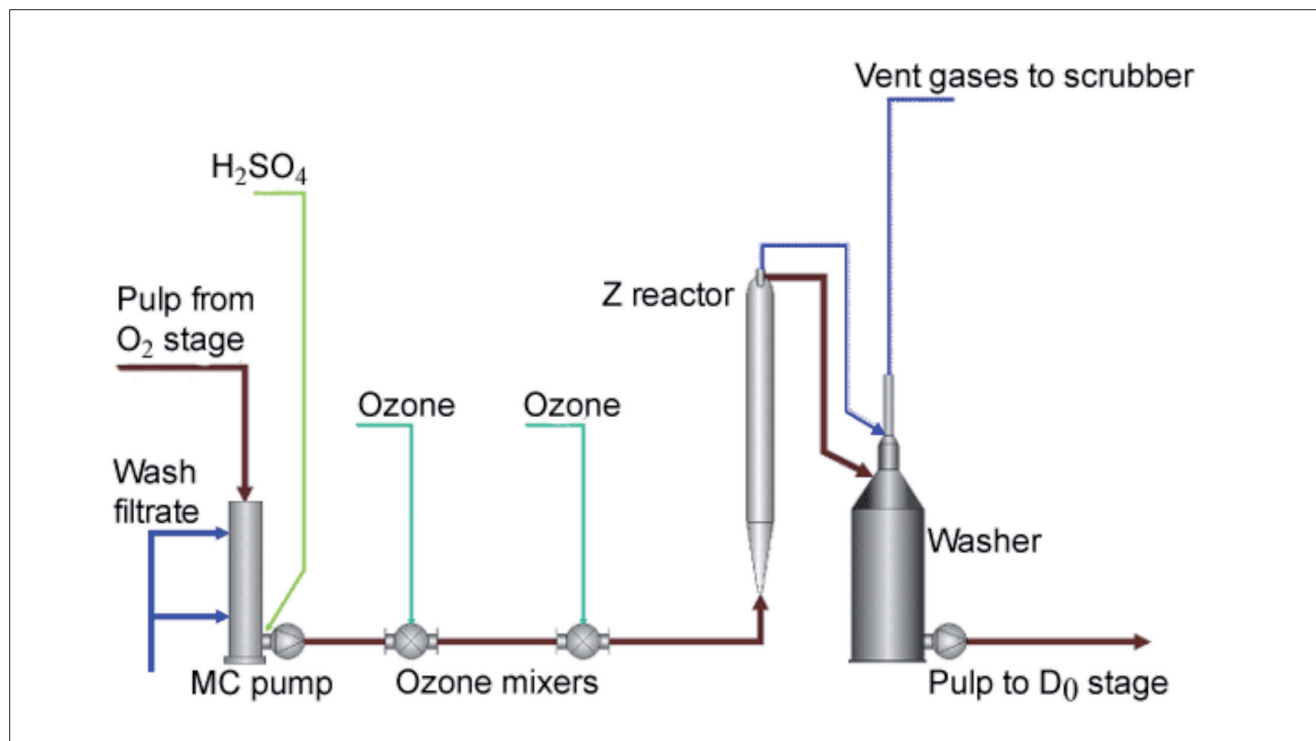


Fig. 1. MC ozonization.

Introduction

Ozone is an effective delignifying and bleaching agent for chemical pulps. Ozone bleaching is usually located after oxygen delignification but it can also be located between alkaline- or peroxide stages. Ozone has a strong delignifying influence after oxygen delignification, but between alkaline- and peroxide stages ozone is used to activate the bleaching process. Nowadays ozone is often used also in initial bleaching because of its synergistic influence.

The process

Conventional bleach plant equipment cannot be used in ozone bleaching, but it requires a special equipment. Unlike other bleaching chemicals ozone reacts with pulp in a few seconds. Therefore large bleaching towers are not necessarily needed in ozone bleaching. Mixers are in key position in ozone stage. Most of the reactions in Z stage take place within a very short time inside the mixer itself.

Ozone bleaching can be done at high pulp consistency or at medium consistency. If operating at medium consistency (10 – 15 %) an MC-mixer is used, which mixes the ozone gas into the pulp. Figure 1 shows a typical medium consistency ozone stage with two mixers included. Often ozone is brought only in the first mixer and following mixers mix same gas and pulp again.

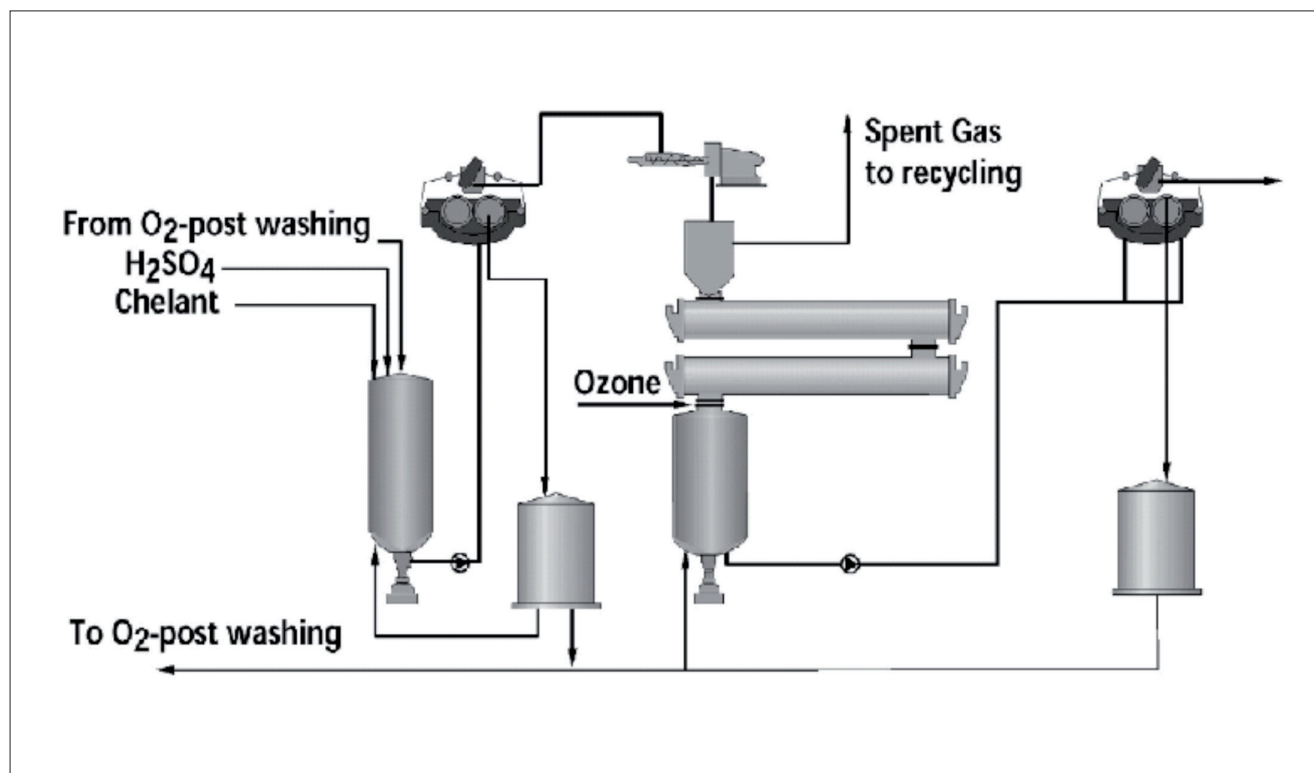


Fig. 2. HC ozonization.

At high consistency (35 – 45 %) pulp and ozone are mixed in a specially designed paddle reactor. Gas flows are controlled by two fans and the pulp is diluted at the reactor outlet. HC ozonization is more effective way than MC ozonization to decrease kappa number. In addition HC ozonization makes it possible to use a non-pressurized reactor. Figure 2 shows a typical high consistency ozone bleaching stage.

The temperature of the pulp is measured because at high temperature ozone gas breaks up and fiber strength decreases. The pulp is cooled if necessary. However cooling is a very expensive procedure.

Spent ozone is recycled and used again. At high temperature ozone breaks up to oxygen which can be used in other processes.

Table 1 gives the conditions usually used in an ozone stage.

Table 1. Typical conditions in an oxygen stage.

final pH	2 - 3
temperature	30 - 50 °C
consistency (MC / HC)	10 - 15 % / 35 - 45 %
time	1 - 2 min

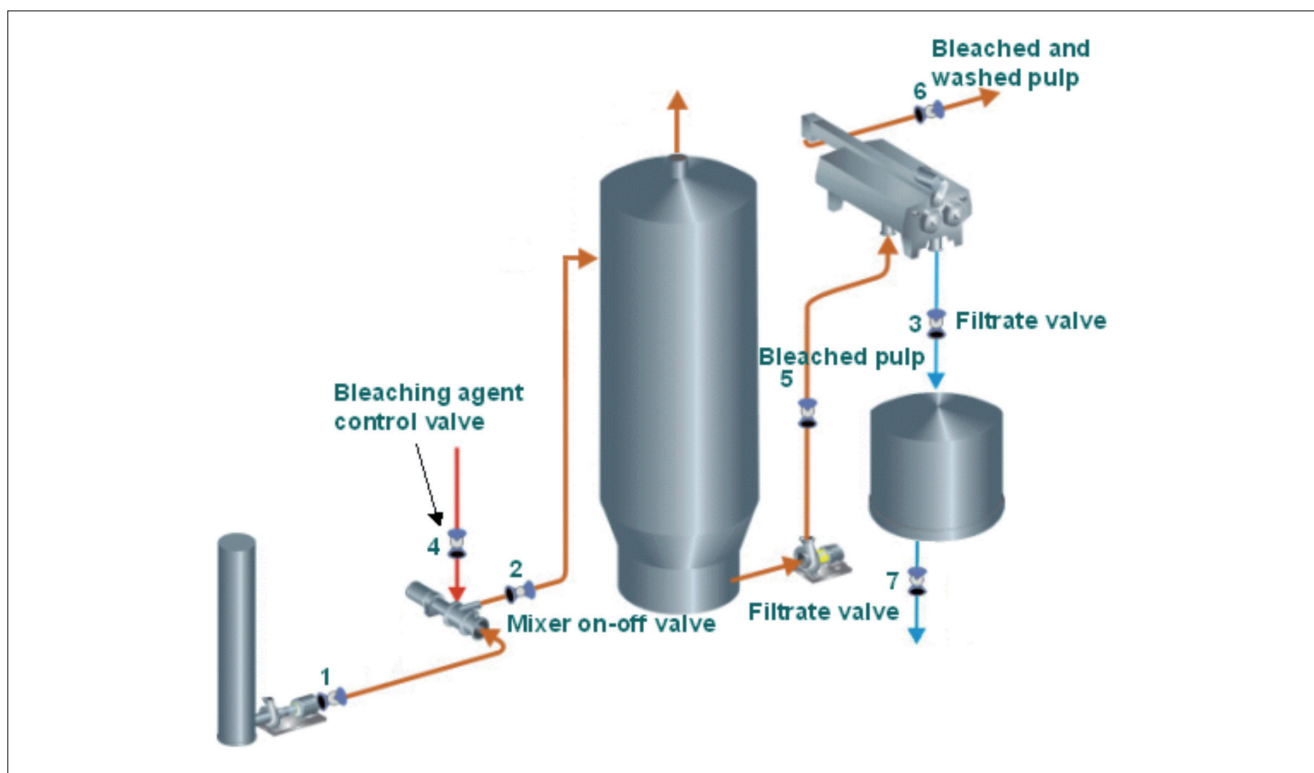


Fig. 3. Valves in ozone bleaching.

Valves

Figure 3 shows valves in ozone bleaching. Table 2 gives valve types and materials (example materials are in brackets). Pressure ratings are sized by pump sizes.

Pulp flow is controlled by MC control valve. Mixer mixes the ozone gas into the pulp. Mixer on-off valve controls pulp-ozone compound flow from mixer to Z reactor. Used ozone is led to recycling from top of the reactor.

Bleached pulp is pumped to final washing system where chemical left over and water soluble reaction products are removed. After pulp washing it is led to the next bleaching stage. Filtrate valves give out used chemicals to treatment. Depending on the process, valves 3, 5 and 6 are not always used.

MC control valve is made of CG8M, which tolerates corrosion a bit better than CF8M. Neither of these materials tolerates pure ozone. That is why bleaching agent control valve has to be made of CF8 or ceramic (ZrO₂). CF8 is not a standard material for segment valves.

Table 2. Valve types and materials in ozone bleaching.

Valve	Name	Type	Material	E.g.
1	MC control valve	Segment	CG8M (317 SS)	R2_S...CJJK
2	Mixer on-off valve	Ball	CF8M (316 SS)	M1_B...AP
3	Filtrate valve	Segment or butterfly	CF8M	LW7_BA...AAJAT
4	Bleaching agent control valve	Ball or segment	CF8* (304 SS) or ZrO ₂ (ceramic)	E2_A...XZ
5	Bleached pulp	Ball or segment	CF8M	RE_A...AJJST
6	Bleached and washed pulp	Segment or butterfly	CF8M	RAA...AS
7	Filtrate valve	Segment or butterfly	CF8M	LW7_BA...AAJAT

* Serie RE segment valve, material

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