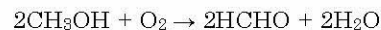
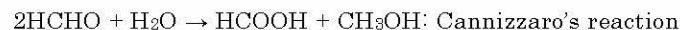
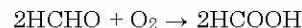


12. Formalin Purification

Formaldehyde is manufactured by oxidation of the mixture of vaporized methanol with air catalyzed by silver metal or a mixture of an iron oxide with vanadium at around 600 °C:



Formalin is an aqueous solution of formaldehyde that adsorbs the reaction products and thus it includes impurities such as formic acid of 50 ~500 mg/l, a byproduct, and small amounts of metal ion dissolved from metal catalysts and facility materials. The reaction scheme to form formic acid is not yet clear, but it is thought to be two-step reaction of oxidation with a Cannizzaro's reaction.



Since formalin is unstable against alkalis and thermally, it is added with 4 ~13% methanol, as a stabilizer to form $\text{CH}_2(\text{OH})\text{OCH}_3$, to prevent formic acid formation and precipitation of paraformaldehyde, hydrated polymer of formaldehyde.

Traditional formalin, around 40% concentration, is widely used as a raw material to produce fungicides, agrochemicals, synthetic resins and other organic compounds. In recent years, the demand for formalin has been diversified and thus the highly concentrated one, $\geq 50\%$, the non-methanol grade with 0 ~1% methanol and low methanol grade are on the market. Some products need to be highly purified, the amount of impurities are limited. IERs are applied for those purposes.

The purification methods with IERs are as follows:

- 1) AERs only
- 2) CERs and then AERs
- 3) CERs, AERs and mixed bed system

The simplest method 1) that can remove formic acid only is applied for the moderate needs. The method 2) is for the cases where metal ions should be eliminated and is commonly applied for general fields. The last method 3) is for highly purified needs.

Regarding regeneration of method 2), cocurrent regeneration is generally used. The countercurrent regeneration is, in SACERs particularly, recommended, from the point of the quality and effectiveness not only from saving of rinse waters and regenerants. (*Please see the chapter of Water Treatments.*)

SACERs with chemical and physical stabilities are recommended as CERs for purification of formalin.

