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Original Research Paper

Research on Fungicides Mixing Processing of Sewage Treatment in Oilfield

Zhao Lijun*, Li Qingsheng and Wang Xusheng***
*Electrical and Electronic Engineering Department, Chengde Petroleum College, Chengde, 067000, Hebei, PR China
**Teaching Affairs Office, Chengde Petroleum College, Chengde 067000, PR China

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ABSTRACT

Aiming at the problem of water pollution and serious deficiency of water resources, sewage disposal system was researched and applied to the sewage treatment in oil field, and types of fungicide and germicidal mechanism were also discussed. Fluent, a fluid engineering software, was used to simulate the sterilization flow, and the results showed that different effects of fungicide mainly depended on different pH and different compatibility conditions. Under certain conditions, it was not allowed to use fungicides. Besides, size of sterilization tank, location of import and export, location of adding drug mouth and pump displacement were also important influencing factors for sewage and mixing procedure of fungicides.

INTRODUCTION

Unreasonable oilfield sewage recycle and emissions are undesirable in oilfield exploitation, which not only lead to the failure of ground equipment and formation plugging, but also cause environmental pollution (Dexu et al. 2001, Jingfang 2006). Therefore, in view of the oilfield water corrosion, the scaling damage and the strong bacteria corrosion, various scale prevention and disinfection measures are constantly adopted to improve the oil field water treatment technology. As a result, "three prevention" treatment to improve the quality of oil field water has become an important research topic. This paper studied the current oilfield oily sewage treatment technology and fungicides using Fluent fluid engineering simulation software. The process of sterilization was simulated, the sectional velocity and trace diagram were mapped, and the sewage and its influence on the effect of drug combination at different positions of dosing were also analysed.

TYPES OF FUNGICIDES AND STERILIZATION MECHANISM

In the oil field water injection system, in order to prevent microbial corrosion of pipelines and equipment, as well as the problems such as sludge blocking, necessary measures must be taken to control related microbes. To prevent microbe growth, the easiest way is the reasonable use of chemical fungicides (Rui et al. 2007, Tianxiang et al. 2011).

Types of fungicides: According to chemical structure, fungicides can be divided into two types: organic fungicides and inorganic fungicides (Zhu et al. 2002), of which the former have quaternary ammonium salt, organic chlorine, disulphide cyano methane, glutaraldehyde, etc., while the latter have chlorine, ozone, sodium hypochlorite and so on. According to the sterilization mechanism, fungicides can be divided into oxidizing bactericides and non oxidizing bactericides. Chlorine and sodium hypochlorite belong to oxidizing bactericides, while quaternary ammonium salt and glutaraldehyde are non oxidizing bactericide.

The sterilization mechanism: The bactericidal mechanism of fungicides can be divided into three kinds as follows: (1) the permeability damage or decomposition of microbes in the body; (2) the inhibition of bacterial metabolic processes such as protein synthesis; and (3) oxidation complexation biochemical process within the bacterial cell.

USING THE FLUENT SOFTWARE TO SIMULATE THE STERILIZATION PROCESS

According to the characteristics of every kind of flow physics, Fluent software can be used to simulate incompressible body to highly complex within the scope of compressible flow. Through adopting suitable parameters for its numerical method, such as computing speed, stability, precision and so on, the optimization of various aspects can be achieved. Therefore, the Fluent software can be used in fluid flow, heat transfer, chemical reaction and other related industries (Zhanzhong et al. 2004). It can offer abundant physical model, advanced numerical method and powerful function of preprocessing and postprocessing. As a result, Fluent has been widely used in the aerospace, automobile design, oil and gas, and turbine design.

This paper applied Fluent software to simulate the sterilization process. In the simulation process, the default

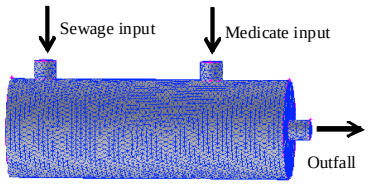

Fig. 1: The grid figure of sterilization pot.

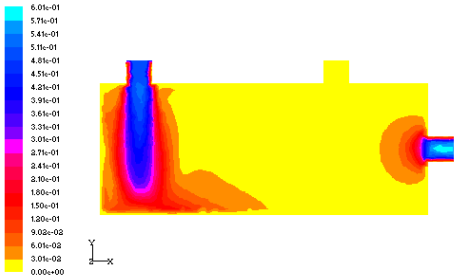

Fig. 2: z = 0 the sectional velocity profile.

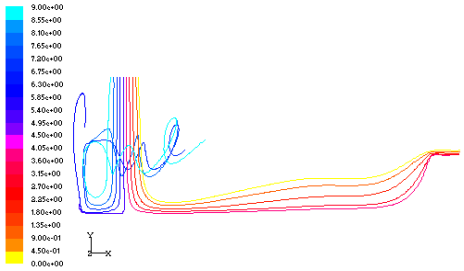

Fig. 3: The trace map form import and export.

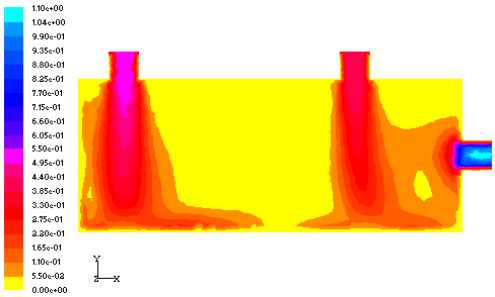

Fig. 4: z = 0 the sectional velocity profile.

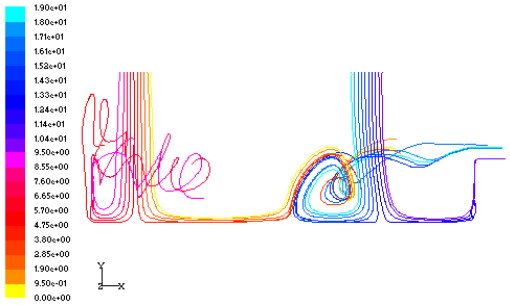

Fig. 5: The trace map from import and export.

speed unit was set as m/s, and the default colour on the left side of the coordinates was the different trace number.

Sterilization equipment calculation model I: Sterilization equipment model I is established by using Fluent software, as shown in Fig. 1.

Based on sterilization equipment model I, the sterilization process can be simulated using Fluent software.

Simulation of the sterilization pot without dosing process: The velocity profile and the track chart are shown in Figs. 2 and 3, respectively.

Simulation of the sterilization pot dosing process: The velocity profile and the track chart are shown in Fig. 4 and Fig. 5, respectively.

According to the simulation results of the velocity profile and the track chart after dosing, it can be seen that the mixing effect of reagents and sewage by model I is undesirable. Therefore, some measures should be taken to further improve the sterilization pot model.

Sterilization equipment calculation model II: In order to improve the sterilization equipment calculation model I, the sterilization equipment calculation model II is established as shown in Fig. 6.

Simulation of the sterilization pot not dosing process: The velocity profile and the track chart are shown in Figs. 7 and 8, respectively.

Simulation of the sterilization pot dosing process: The velocity profile and the track chart are shown in Figs. 9 and 10, respectively.

According to the simulation results of the velocity profile and the track chart after dosing, it can be seen that the mixing effect of reagents and sewage by model II is better than that by model I.

Sterilization equipment calculation model III: In order to obtain better mixing effect, further optimization is conducted on the sterilization pot model. The established sterilization equipment calculation model III is shown in Fig. 11.

Simulation of the sterilization pot without dosing process: The velocity profile and the track chart are shown in Figs. 12 and 13, respectively.

Simulation of the sterilization pot dosing process: The velocity profile and the track chart as shown in Fig. 14 and Fig. 15, respectively.

In order to further study, model III is build on models I and II. The simulation results show that when the sterilization pot size and location of import and export are fixed, dosing position and pump displacement will affect the water flow and antiseptic effect.

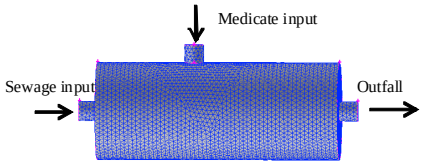

Fig. 6: The grid figure of sterilization pot.

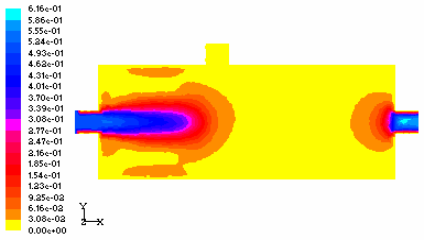

Fig. 7: z=0 the sectional velocity profile.

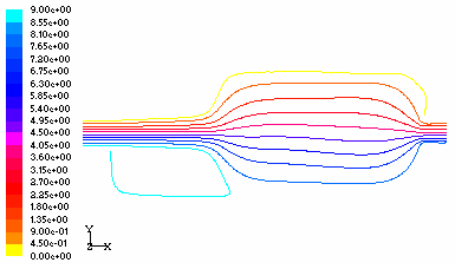

Fig. 8 :The trace map form import and export.

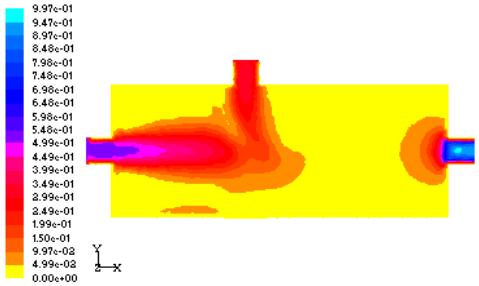

Fig. 9: z=0 the sectional velocity profile.

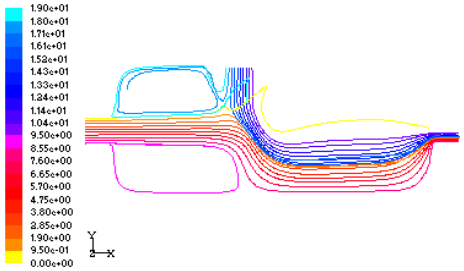

Fig. 10: The trace map form import and export.

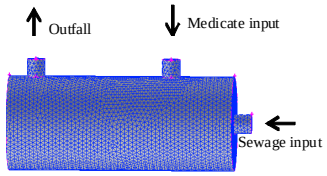

Fig. 11: The grid figure of sterilization pot.

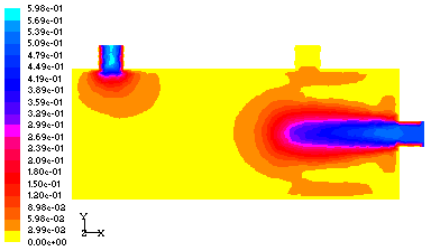

Fig. 12: z = 0 the sectional velocity profile.

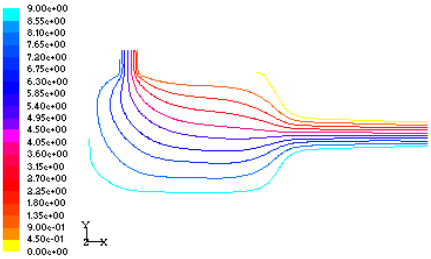

Fig. 13: The trace map form import and export.

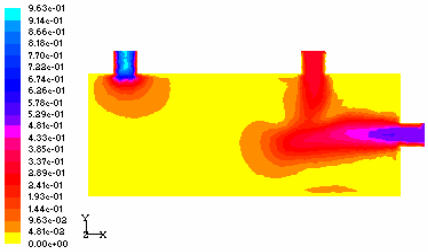

Fig. 14: z = 0 the sectional velocity profile.

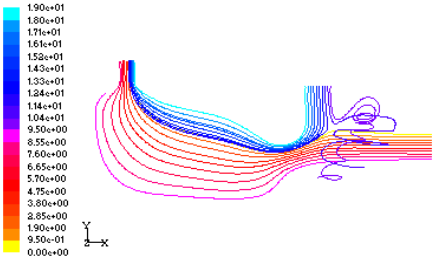

Fig. 15: The trace map form import and export.

Trace charts of Models I, II and III in different dosing rates: Using the simulation software to render model I, II and III, the trace charts from import and export in different dosing rates can be illustrated as for model I (Figs. 16 and 17), for model II (Figs. 18 and 19) and for model III (Figs. 20 and 21).

According to the above simulation results of models I, II and III under the same conditions, the advantages and disadvantages of the three kinds of models can be summarized as given in Table 1.

CONCLUSIONS

Table 1: The comparison of three models.

Model	Advantage	Disadvantage
I	Simple model structure, cost saving, good effect within vortex distribution.	Drug flows easily before the mixing.
II	Simple model structure, cost saving, long mixing time inside	Drug and sewage are easily layered, and it is difficult to produce eddy current.
III	Good effect inside and outside the vortex distribution.	The model structure is complex, the placement is inconvenient, and the cost is higher.

Model I

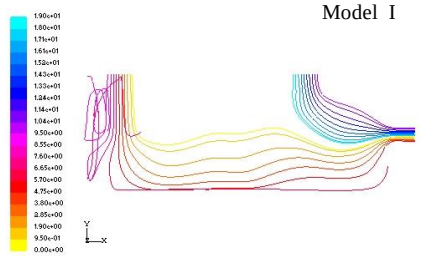

Fig. 16: The trace chart of 0.1 m/s speed.

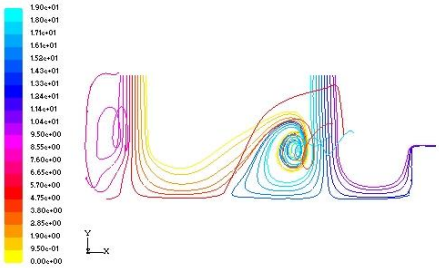

Fig. 17: The trace chart of 0.5 m/s speed.

Model II

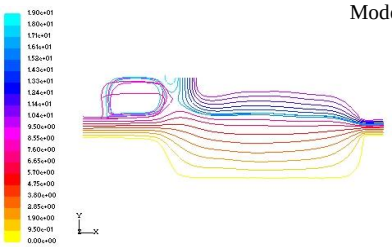

Fig. 18: The trace chart of 0.1 m/s speed.

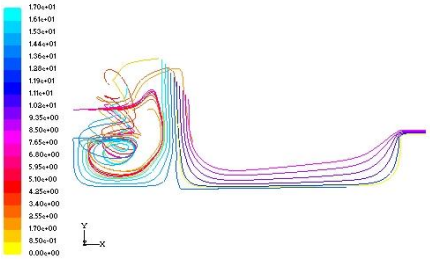

Fig. 19: The trace chart p of 0.5 m/s speed.

To improve the performance of oil field wastewater treatment system, this paper applied Fluent fluid engineering software to the sterilization process simulation, and some conclusions can be drawn as follows:

1. Given the sterilization pot size and the position of import and export, dosing position and pump displacement were two important factors that influence the mixture of sewage and fungicide.
2. Given the sterilization pot size, the position of import and export and the location of dosing mouth, pump displacement should be rationally selected to obtain proper inlet velocity.
3. Given the sterilization pot size, the position of import and export and the pump displacement, the location of dosing mouth should be set properly.

Model III

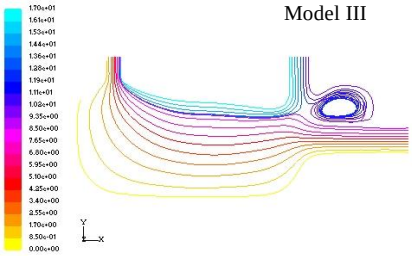

Fig. 20: The trace chart of 0.1 m/s speed.

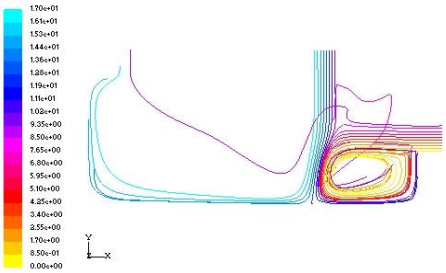

Fig. 21: The trace chart of 0.5 m/s speed.

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