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The Optimization of Agent Formula by Orthogonal Experiment

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Abstract

In this paper, we use orthogonal experiment to get the best formula of components for the environmental protection alcohol resistance drainage agent. This agent is formed by foaming agent, gas produce agent, surfactant, alcohol resistant agent and corrosion inhibitor. We take the mass that the agent left after distinguishing the acetone fire and oil fire as the test index. The best formula of the agent is: foaming agent 1%, gas agent 7%, 0.7%, organic silicon surfactants 0.7% alcohol resistant agent 7.5%, corrosion inhibitor 3%. This drainage agent is environment friendly and be harmless to the human body.

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Keywords: drainage agent, orthogonal experiment, environmental protection, alcohol resistance

1. Preface

Water fire extinguishing agent is water, penetrating agent, flame retardant agent and other additives, general with droplets or in the form of droplets and foam mixed liquid extinguisher to put out a fire. Alcohol resistance water fire extinguishing agent is applicable to put out A fire class A and class B fires (both water-soluble and water-insoluble liquid fuel) drainage agent. This paper studies the environmental protection alcohol resistance drainage agent with high fire extinguishing efficiency, when used without irritating gases and vapors, excluding the characteristic of persistent organic pollutants (pops) [1]. When using the human body will not cause stimulation, also won't damage to the environment, is a real zero pollution environmental protection water fire extinguishing agent. And has function of alcohol resistant, can put out all including organic solvents such as acetone, ethanol A, B class A fire. In today's environmental priority development of environmental protection under the background of extinguishing agent has the positive significance. In this paper, we study the environmental protection alcohol resistance water system consists of foaming agent, produce gas extinguishing agent, surfactant, alcohol resistant agent, corrosion inhibitor of 5 kinds of functional components. In this paper, through the orthogonal experiment it is concluded that the environmental protection alcohol resistance drainage agent the best formula.

2. The test

2.1. Test raw material

In this paper, we study the environmental protection alcohol resistance drainage agent consists of the following five kinds of functional components.

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（1）Foaming agent: APG
（2）Gas agent： Sodium bicarbonate
（3）The surfactant： Organic silicon
（4）Alcohol resistant agent： Sodium alginate solution of 2%
（5）Corrosion inhibitor: 1H-Benzotriazole and Ethylene glycol.

2.2. The experiment design

In this paper, using orthogonal table design agent formula, shown in the following table：

Table 1 Fire extinguishing agent formula

The serial number	Foaming agent/‰	Gas agent/%	Penetrating agent /‰	Alcohol resistant agent /%	Corrosion inhibitor /%
1	10	7	5	5	3
2	10	8	6	7.5	5
3	10	9	7	10	7
4	10	10	8	12.5	9
5	12	7	6	10	9
6	12	8	5	12.5	7
7	12	9	8	5	5
8	12	10	7	7.5	3
9	14	7	7	12.5	5
10	14	8	8	10	3
11	14	9	5	7.5	9
12	14	10	6	5	7
13	16	7	8	7.5	7
14	16	8	7	5	9
15	16	9	6	12.5	3
16	16	10	5	10	5

2.3. The text method

This paper USES the portable stored-pressure type 2 l water type fire extinguisher [2], fire extinguishing agent filling volume of 2 l. According to table 1 test number with the corresponding formula 2 kg of water fire extinguishing agent in portable fire extinguisher, filling the carbon dioxide gas, pressure (gauge pressure) (1.2 + / - 0.1 MPa. After filling fully rocked the sodium bicarbonate and carbon dioxide dissolves in fire extinguisher cylinders, ensure fire extinguishing agent to achieve the optimal effect of fire. Fire extinguishing experiment model USES is 8 b oil pan [3] fire model, fuel for the rubber industry with [4] or acetone solvent oil. Test was carried out in outdoor, so try to avoid experiment in windy or rainy weather.

Acetone when fire tests do not add water, every time take 31acetone into the oil pan (basic oil pan bottom cover). Destroy the test operation method and solvent oil fire acetone, fire before you pour into solvent oil water will be at the bottom of the oil pan cover, after that stir in 1 l water solvent oil in the upper, after put out the fire.

When the fire which according to the regulations of the national standard GB4351.1-2005 using the minimum jet distance of 3 m with a fire extinguisher extinguishing experiment [5]. To ignite fuel, fuel precombustion after 30 s combustion stability on oil pan spray extinguisher to put out the fire. Try to keep a fire extinguisher in the process of extinguishing the continuous injection [6], visual doesn't appear again within 1 min after the flame is extinguished, and disc and the rest of the fuel, the fire success. With scales of fire extinguishers and fire extinguishing agent remaining total quality minus the empty fire extinguisher quality get the rest of the quality of the fire extinguishing agent. Scrubbing the oil pan, replace the fuel for the next test.