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THE EXTINCTION OF COOKING OIL FIRES BY VARIOUS AGENTS

by

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SUMMARY

Carbon dioxide, dry powder, foam, and a fire-resisting cloth, have been examined for their effectiveness in the extinction of small fires in cooking oil. The most effective method of dealing with such fires was found to be by smothering, either with a cloth, or by replacing the lid of the cooking vessel.

MINISTRY OF TECHNOLOGY AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

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Introduction

This note describes some experiments in which various agents were used for the extinction of fires in cooking oils. The work was done at the request of the Joint Fire Prevention Committee's Technical Sub-Committee on Use of Fire Extinguishers.

It is well known that the application of water to oil, heated to a temperature above 100°C (212°F), is likely to cause the oil to "sputter", due to the sudden formation of steam at the surface of the hot oil. In some cases, it may cause the oil to boil over due to the formation of steam below the surface of the oil. Water is not, therefore, recommended for the extinction of fires in cooking oil, because of the danger of spreading the fire. The Committee were concerned that the use of foam on these fires might also be dangerous, especially in the hands of inexperienced users.

Details of cooking oil used

A proprietary ground nut oil having the following approximate fire properties, when fresh, was used in the experiments.

Smoke point °C (°F)	Flash point °C (°F)	Fire point °C (°F)	Initial spontaneous ignition temperature °C (°F)	Final spontaneous ignition temperature °C (°F)
190 (374)	300 (572)	350 (662)	360 (680)	270 (518)

Details of extinguishing agents used

(a) "Fire resisting" cloth - glass fibre cloth placed over fire tank.

(b) Carbon dioxide - applied from a proprietary 2.27 Kg (5 lb) capacity fire extinguisher.

(c) Dry powder - standard sodium bicarbonate based dry powder applied from a proprietary 4.54 Kg (10 lb) capacity fire extinguisher.

(d) Foam - protein-based foam applied from a proprietary 9.1 l (2 gal) capacity air-foam extinguisher.

Description of test fire

Two fire tanks, one of 0.25 m (10 in) diameter and the other of 0.51 m (20 in) diameter, were used in the tests, each tank being 0.25 m (10 in) deep and containing a 0.08 m (3 in) depth of oil. The oil was heated by placing gas rings under the tank and its temperature was measured by a mercury in glass thermometer.

Description and results of tests

Seven tests were made, as described below. In all tests except Nos. 2 and 7 the oil was heated until it ignited spontaneously before extinction was attempted.

Test 1. "Fire resisting" cloth (0.25 m (10 in) diameter tank).

After spontaneous ignition of the oil, the flames were smothered by placing the cloth over the top of the tank for 30 sec, but self-ignition of the oil occurred 10 to 15 sec after removal of the cloth.

The test was then repeated, but the cloth was left in position for about 15 min, until the oil had cooled to below its final spontaneous ignition temperature (270°C) (518°F). No re-ignition of the oil occurred.

Test 2. Carbon dioxide (0.25 m (10 in) diameter tank).

The oil was heated to 320°C (608°F), ignited by the application of a flame, and allowed to burn for 30 sec. The flames were then extinguished in 2 sec by the application of carbon dioxide. The oil did not re-ignite.

Test 3. Carbon dioxide (0.25 m (10 in) diameter tank)

After spontaneous ignition of the oil, the flames were extinguished by the application of carbon dioxide for a period of 5 sec. The oil re-ignited a few seconds after application of the agent had ceased.

A repeat test gave a similar result

Test 4. Dry powder (0.25 m (10 in) diameter tank)

After spontaneous ignition of the oil, 4.54 Kg (10 lb) of dry powder were discharged into the fire tank, and the flames were extinguished almost immediately. During the powder discharge, a brown "froth" formed and overflowed from the tank. No re-ignition occurred.

Test 5. Foam (0.25 m (10 in) diameter tank)

The oil was heated until it ignited spontaneously, after which the application of foam for about 3 sec gave rise to a plume of gas and flame about 3.7 m (12 ft) high. During this test, some oil splashed out of the tank.

A repeat test gave a similar result.

Description of test fire (Cont'd.)

Test 6. Foam (0.51 m (20 in) diameter tank)

The oil was heated to its spontaneous ignition temperature and allowed to burn for 60 sec before fire fighting began. In order to reduce agitation of the oil, the foam was projected from the extinguisher over a distance of 4.6 m (15 ft) to fall "gently" onto the fire as "flakes". A plume of gas and flame, about 3.0 m (10 ft) high, occurred during the first 3 or 4 sec of foam application, and the fire was extinguished in 10 seconds.

Test 7. Foam (0.51 m (20 in) diameter tank)

In this test the oil was heated to 300°C (572°F), ignited by the application of a flame and allowed to burn for about 60 seconds. Foam was then applied to the fire, as described under Test 6, for 5 sec only. Extinction of the fire was achieved during this time but spontaneous ignition of the oil occurred after a further 3 seconds. Further foam application for 3 sec extinguished the fire and the oil did not re-ignite.

Discussion and conclusion

(1) Smothering cloth and carbon dioxide

The safest and most effective method of dealing with a fire in a small pan of cooking oil was found to be by smothering, either by carefully replacing the lid of the pan, or by covering the pan with a "fire-resisting" cloth. In the case of larger cooking oil fires, such as those which may occur in fish fryers, carbon dioxide could be injected into the air space above the oil, and the lid of the fryer closed.

In all cases the cloth or lid should be left in position until the oil has cooled to a safe temperature, i.e. at least 20°C (36°F) below its final spontaneous ignition temperature.

(2) Dry Powder

Extinction of cooking oil fires is possible with dry powder but use of this agent gives rise to a "froth" which may overflow from the tank.

(3) Foam

Foam will extinguish fires in cooking oil, but, during the initial application period, when the oil is very hot, use of the agent may produce a large plume of gas and flame. This would be alarming to an inexperienced fire-fighter, especially if the fire occurred in a small room.