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MISCELLANEOUS TARGETS

JAPANESE FUELS AND LUBRICANTS. ARTICLE 5
RESEARCH ON ROCKET FUELS
OF THE HYDROGEN PEROXIDE-HYDRAZINE TYPE

U.S. NAVAL TECHNICAL MISSION TO JAPAN

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U. S. NAVAL TECHNICAL MISSION TO JAPAN

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From: Chief, Naval Technical Mission to Japan.
To: Chief of Naval Operations.

Subject: Target Report - Japanese Fuels and Lubricants, Article 5 -
Research on Rocket Fuels of the Hydrogen Peroxide -
Hydrazine Type.

Reference: (a) "Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering chemical research by the Japanese Navy on rocket fuel of the hydrogen peroxide-hydrazine type as outlined by Targets X-09, X-10 and X-38(N) of Fascicle X-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Comdr. G. L. Neely, USNR, Lt. Comdr. C. S. Goddin, USNR, and Lt. W. H. Millet, USNR, assisted by Ens. E. R. Dalbey, USNR, as interpreter and translator.



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X-38(N)-5

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**JAPANESE FUELS AND LUBRICANTS - ARTICLE 5
RESEARCH ON ROCKET FUELS
OF THE HYDROGEN PEROXIDE-HYDRAZINE TYPE**

"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE X-1, TARGETS X-09, X-10, AND X-38(N)

FEBRUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

MISCELLANEOUS TARGETS

JAPANESE FUELS AND LUBRICANTS - ARTICLE 5 RESEARCH ON ROCKET FUELS OF THE HYDROGEN PEROXIDE-HYDRAZINE TYPE

Japanese naval research pertaining to rocket fuels of the hydrogen peroxide-hydrazine type has been investigated. This report deals primarily with the manufacture of hydrazine and 80% hydrogen peroxide solutions and with combustion studies of the reaction between these two materials. This rocket fuel was to be utilized principally in the newly developed SHUSUI airplane. It was reported that only one flight test was successfully completed before the termination of the war.

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REFERENCES

Location of Target:

First Naval Fuel Depot, OFUNA, Kanagawa Prefecture.

Japanese Personnel Interviewed:

H. FUJIMOTO, (Ph. D.) Engineering Commander, Japanese Navy, (very capable research engineer).

S. SHINODA, Naval Chemical Engineer, (designer of hydrogen peroxide concentration plant at the First Naval Fuel Depot, OFUNA).

S. ENDO, Engineering Lieutenant Commander, Japanese Navy, (research engineer - the manufacture of hydrazine).

M. SHIMO, Engineering Lieutenant, Japanese Navy, (research engineer - combustion studies of hydrogen peroxide-hydrazine mixtures).

INTRODUCTION

The Japanese Navy became actively interested in the development of rocket fuels in June 1944. It was planned that the fuel to be developed would be utilized in the SHUSUI airplane and in the KAITEN torpedo. This report summarizes the technical information obtained from the First Naval Fuel Depot, OFUNA, relative to such research activities and the application of these activities to the commercial production of rocket fuel of the hydrogen peroxide-hydrazine type.

Pertinent detailed research papers have been prepared in English by Japanese technical personnel, under the direction of the U. S. Naval Technical Mission to Japan. These papers were reviewed with the Japanese authors, revised, and are presented herewith as an integral part of this report, designated as Enclosures (B)1 to (B)10, inclusive. A summary of this work has also been prepared in English for inclusion in this report by Chemical Engineering Commander H. FUJIMOTO (Japanese Navy), and is presented herewith as Enclosure (A).

Since the Japanese research reports, drawings, and other important documents of the First Naval Fuel Depot had been burned during August 1945 at the direction of the Director of the Depot, it was necessary to recall the Japanese technical personnel and to reconstruct this information from laboratory notebooks, laboratory apparatus, and pilot plant equipment. This reconstruction, for both this report and other reports pertaining to the First Naval Fuel Depot, continued for a period of nearly three months. It is to be realized that, in spite of efforts expended in reviewing the reports submitted as Enclosures (A) and (B), they do not conform to American standards, and many errors have inadvertently been included in the translation by the Japanese authors. However, these reports do indicate with considerable accuracy the quality and extent of Japanese research pertaining to the development of the type of rocket fuels which the Japanese Navy planned to use.

The information contained in this report was obtained in connection with an investigation of fuel and lubricant research carried out by the Japanese Navy at the First Naval Fuel Depot. No attempt has been made to supplement these findings by investigating rocket fuel research conducted elsewhere in Japan.

THE REPORT

The rocket fuel which was to have been employed by the Japanese Navy consists of a solution of 80-85% hydrogen peroxide as an oxidizing agent and a 30% solution of hydrazine hydrate in a 8 : 2 methanol-water mixture as a reducing agent. The detailed reports pertaining to the development, improvement, and application of this fuel fall into the following general categories:

1. Laboratory studies on the manufacture, stabilization, and storage of concentrated hydrogen peroxide solutions.
2. Laboratory and pilot plant studies on the synthesis of hydrazine.
3. Design and operation of hydrogen peroxide concentration plants.
4. Combustion studies of peroxide-hydrazine mixtures.

Enclosure (A) summarizes the content of these reports and depicts the role of this research in the overall rocket fuel program. Detailed data, drawings, and flow sheets are presented in the individual reports of Enclosure (B). Of primary interest are the papers on the design and construction of hydrogen peroxide concentration plants (Enclosure (B)-7) and on the combustion studies of hydrogen peroxide-hydrazine mixtures (Enclosure (B)-10).

It was planned to construct a number of hydrogen peroxide concentration plants in Japan capable of producing a total of 3,000 tons of 80% hydrogen peroxide per month. Two units, having a combined capacity of 90 tons per month, had been built at the First Naval Fuel Depot, OFUNA. One of these had been in operation since November 1944 and the other was completed in August 1945. Construction of a dditional concentration units was underway at other locations, but none of these had been completed at the close of the war, except a 100 ton per month plant at YAMAKITA.

Interesting investigations were carried out in regard to the choice of materials for constructing plants for concentrating hydrogen peroxide. A plant had been built at the Chosen Nitrogen Company (Korea) using aluminum vessels and pipes, but violent decomposition of the concentrated hydrogen peroxide occurred, rendering the plant useless. At OFUNA, after a thorough investigation, tin and porcelain were selected as the available materials which were most resistant to attack by hydrogen peroxide. In the design of the OFUNA plant, tin-lined vessels, tin or porcelain pipes, large porcelain cocks and other porcelain fittings were used exclusively. The fabrication of these porcelain fittings was based upon Japan's ancient technique in the manufacture of porcelain dishes and other household articles. After concentration, the hydrogen peroxide was stored underground in tin-lined steel tanks of 10 kiloliter capacity.

It is of interest that during 1945 the hydrogen peroxide-hydrazine program was one of the two research projects having the highest priority at the First Naval Fuel Depot. The other project was that for obtaining aviation gasoline from pine root oil (NavTechJap Report, "Japanese Fuels and Lubricants" Article 4 - Pine Root Oil Program.) The fact that both of these programs were concerned with aviation fuels serves to emphasize Japan's critical position in regard to this important resource during the final year of the war.