# Study Material: Preparation of Boric Acid from Borax

## Introduction

Boric acid ($H_3BO_3$), also known as hydrogen borate, is a weak acid of boron often used in antiseptics, insecticides, and in various industrial applications. It is prepared from borax (sodium tetraborate decahydrate, $Na_2B_4O_7 \cdot 10H_2O$), which is a naturally occurring boron compound.

## Chemical Equation

The preparation of boric acid from borax involves a simple reaction with a mineral acid such as hydrochloric acid (HCl) or sulfuric acid ($H_2SO_4$). The reaction can be represented as follows:

$$Na2B4O7 \cdot 10H2O + 2HCl \longrightarrow 4H3BO3 + 2NaCl$$

## Stepwise Procedure for Preparation

1. **Materials Required**:
   - Borax ($Na_2B_4O_7 \cdot 10H_2O$)
   - Hydrochloric acid (HCl) or Sulfuric acid ($H_2SO_4$)
   - Distilled water
   - Beakers, stirring rod, and filter paper
   - Hot plate or heating apparatus
2. **Preparation Process**:
   - Dissolve **5 grams of borax** in about **50 mL of distilled water** in a beaker.
   - Heat the mixture gently with continuous stirring to ensure complete dissolution of the borax.
   - To the hot solution of borax, slowly add about **5 mL of dilute hydrochloric acid (HCl)** or sulfuric acid ($H_2SO_4$) with continuous stirring.
   - A white precipitate of **boric acid ($H_3BO_3$)** will begin to form.
   - Continue stirring the mixture until the precipitation is complete.
   - Filter the precipitated boric acid using filter paper and allow it to dry.
3. **Purification**:
   - The boric acid can be further purified by recrystallization from hot water. Dissolve the crude boric acid in hot water and cool the solution to allow pure crystals to form.
4. **Chemical Reaction**:

   $$Na2B4O7 \cdot 10H2O + 2HCl \longrightarrow 4H3BO3 + 2NaCl$$

   The reaction yields boric acid and sodium chloride as a by-product.

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## Applications of Boric Acid

1. **Antiseptic**: Boric acid has mild antiseptic properties, which makes it useful in eye washes and medical ointments.
2. **Insecticide**: It is commonly used as an insecticide to control cockroaches, termites, ants, and fleas.
3. **Preservative**: Boric acid is used in some food preservation processes, though its use as a food additive is restricted in many countries.
4. **Buffering Agent**: It is used as a buffer in various chemical reactions due to its mild acidic nature.
5. **Glass and Ceramics**: Boric acid is a key ingredient in the manufacture of borosilicate glass and ceramics.
6. **Flame Retardant**: It is used in some flame retardant formulations.
7. **Nuclear Power Plants**: Boric acid is used in the control of nuclear reactors as a neutron absorber.

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## Uses of Boric Acid

- **Medical**: Boric acid is used as an antiseptic for burns or cuts, an eyewash, and to treat vaginal infections.
- **Household**: It is used to kill household pests such as ants, cockroaches, and termites.
- **Industrial**: Boric acid is used in manufacturing glass, ceramics, and fiberglass.
- **Chemical Reactions**: It serves as a reagent and pH buffer in laboratories.
- **Cosmetics**: Some cosmetics and skin products use boric acid for its antiseptic and buffering properties.