# **Electrophoresis experiment**

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#### 1. Overview

It is difficult to teach the topics which cannot be seen. Ion is one of them. Some ions have colour and we can show the moving of colour in the electrophoresis.

Direct current power supply of 50V is needed to do electrophoresis experiment. General power supply in the laboratory is 20V. It is possible to do electrophoresis in low voltage, but it takes long time. Simple power supply can be made with light bulb and diode. It can get direct current of 57.5V from general electrical outlet of 230V.

The experiments were done in three types. The first one is acid and base. Both of  $H^+$  and  $OH^-$  cannot be seen. But these ions can change the colour of litmus paper. It is possible to see the colour moving on the litmus paper.



The second one is  $Cu^{2+}$  and MnO4<sup>-</sup>. Both of ions have colour and the moving can be seen on the filter paper with electrolyte solution. The movement can be seen on in the agar base, too. It is easy to do experiment with the filter paper. It takes long for preparing the agar base.

The third one is food colour. Some food colours have electrical charge. They can move in the electrophoresis. But their molar mass is large. It is difficult to do electrophoresis with the filter paper. It may better do with the agar base.

#### 2. Equipment and preparation

2.1 Direct current power supply

The right figure is electrical schematic of power supply.

Materials are two light bulbs and a diode. Small wattage light bulb is better for security. Big one is dangerous if someone touches the two electrodes directly.

# Power supply (Schematic)



#### 2.2 Agar base

Dissolve an agar powder and a little salt in the water and boil them. and pour them in the paper base. Much salt makes difficult to move the big particles like food colour.



## 3. Experiment setting

#### 3.1 Acid & Base

Red and blue litmus papers are put on the slide glass. Both sides are clipped and connected the electrodes. Salt water is put on the litmus papers as a neutral electrolyte solution.



# $3.2 \text{ Cu}^{2+}$ and $\text{MnO4}^-$

Cut a piece of filter paper to the size of a slide glass. Draw a circle at the centare of the filter paper to check the first position.

Clip the edges of the filter paper and glass slide. Drop copper chloride aqueous solution or potassium permanganate solution on the center of the filter paper. Salt water is put on the filter papers as an electrolyte solution. Weak salt water is better.

#### 3.3 Food colour

Clip the edges of the agar base and connected the electrodes. Drop food colour on the center of the agar base.





# 4. Experiment results

## 4.1 Acid & Base

## 4.1.1 HCl (Acid)



A string with hydrochloric acid is put on the middle of the papers.



Red part showing acidity moved to negative electrode on blue litmus paper.

### 4.1.2 CaOH (Base) litmus paper



A small piece of cotton with calcium hydroxide is put on the middle of paper.



Blue part showing basicity moved to positive electrode on red litmus paper.

#### 4.1.3 CaOH (Base) litmus paper and filter paper



Filter paper is put on at first and then two litmus papers are put on it to avoid the reaction of negative electrode.



Positive side of red litmus paper turned blue, but there was no color at negative electrode.



Drop copper chloride aqueous solution on the center of the filter paper. Salt water is put on the filter papers as an electrolyte solution.



Blue color of copper ion moved to negative electrode.



Drop potassium permanganate solution on the center of the filter paper. Salt water is put on the filter papers as an electrolyte solution.



Redish purple color of permanganate ion moved to negative electrode.

## 4.3.1 Red (New Coccine) molar mass 604.48



The ingredient of Red color moved to positive electrode.



The ingredient of Yellow color moved to positive electrode, too.





The moving speed of Blue is slow.



Yellow color moved faster than Blue color because molar mass of Yellow is smaller than Blue one.