

Spreading of Permanganate in Agar Gel

Equipment:

Petri dishes
overhead projector
tweezers

Chemicals:

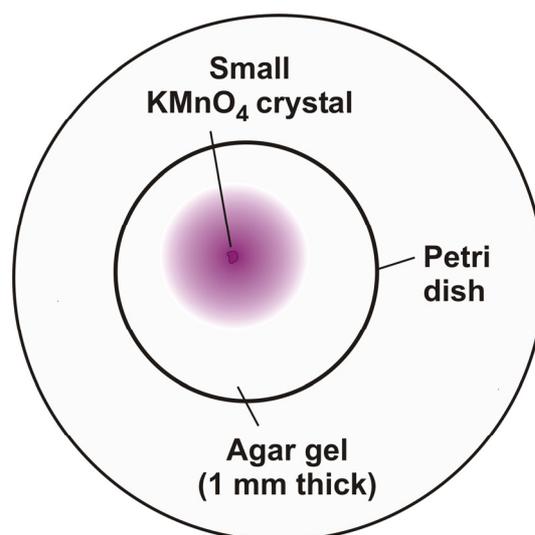
potassium permanganate (solid, in small crystals)
agar powder
deionized water

Safety:

potassium permanganate (KMnO₄):



H272, H302, H410
P210, P273



It is recommended to wear safety glasses and protective gloves.

Procedure:

Preparation: 0,2 g of agar powder are suspended in 20 mL of deionized water. Subsequently, the suspension is brought to boil. Once the liquid becomes clear, the warm solution is poured into one of the Petri dishes, so that a complete layer with a thickness of approx. 1 mm is formed. This layer is allowed to gel.

Procedure: The Petri dish is put on the glass plate of the overhead projector. Two or three small KMnO₄ crystals (diameter of approx. 1 mm) are cautiously distributed on the agar gel.

Alternatively, a second Petri dish is filled with a layer of water and also put on the glass plate of the projector. A small KMnO₄ crystal is then cautiously placed in the middle of the Petri dish.

Observation:

Immediately, a kind of red violet “halo” is formed around each small crystal. Because of its color, the spreading of the “halo” away from the source can be observed easily. The process is much faster in water.

Explanation:

The migration of potassium permanganate from one place to another can be considered as a transformation,



so it is plausible that the chemical potential also controls this process. The transport of substances always follows the direction of the potential gradient. This means that the

substance only migrates spontaneously in the direction where the μ value at the starting point is higher than at the destination. In this case, the concentration dependency of the quantity μ plays a decisive role: The more diluted a substance is, the lower is its chemical potential and the chemical potential can be lowered to any degree if the dilution is strong enough. Therefore, a substance migrates from regions of higher concentration (μ high) into regions of lower concentration (μ low). This is called *diffusion*.

The use of agar gel hinders convection. But the permanganate ions have to work through the crisscrossing network of carbohydrates in the gel and are therefore much slower than in water.

Disposal:

Gel and solution are poured in a special jar for hazardous waste disposal.