



USE OF PHYSICAL AND CHEMICAL FACTORS IN THE DEVELOPMENT OF PLASTINATION ANATOMICAL PREPARATIONS

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ABSTRACT

The fundamental invention of *von Hagens*, known as plastination, allows the creation of safe for human health anatomical preparations. In biological material preparation are used chemical or physical factors to replace tissue fluid by silicone derivatives or polyester. They stop the destruction of tissues, which began after the death causative by microorganisms from the external or internal environment, and their uncontrolled enzymes too. Tissue fluid from the biological material is extracted by chemical dehydrators, silicones impregnate tissue forcefully in conditions of low temperature and low pressure. Drying in plastination S10 technique is carried out with the fumes of chemical compounds. For hardening in P40 technology for preparation of brain plates UV-rays are used.

Key words: plastination, Biodur, S10, P40, safety anatomical preparations, UV

INTRODUCTION

The fundamental invention of *von Hagens*, known as plastination, allows the creation of safe for human health anatomical preparations (1). Plastination is a complex multistage process that continues 4-8 weeks in most techniques. In biological material preparation are used chemical and physical factors to replace tissue fluid by silicone derivatives (2) or polyester co-polymers (3). They stop the destruction of tissues, which begins after the death causative by microorganisms from the external or internal environment, and body uncontrolled enzymes too (4).

Fixation is the first stage of plastination process (5).

Some researchers apply fixation with ethyl alcohol (1).

The most commonly used fixative is 10% aqueous formaldehyde solution. It is imported by perfusion in the vascular system of a dead body (6) and, if necessary, may make additional intramuscular injections with the same solution.

Some authors recommend plastination of old formalin preparations made by the students during dissection exercises (7).

There are complex fixative solutions in which an attempt was made to unite the positive attributes of their components (8).

During the **dehydration** stage of plastination process tissue fluid from the biological material is extracted by chemical dehydrators (6, 9).

The third stage is **forced impregnation** (1, 2). In this stage, in the conditions of low temperature (-25°C) and low atmospheric pressure (98 kPa), S10 resin replaces the dehydrator in tissues. The replacement must be gradually over a four week (10).

During **gas curing stage** occurs curing the S10 resin and drying of the anatomical preparation.

AIM AND PURPOSES

The purpose of this study was to determine the nature of the reactions that take place during the process and plastination factors causing them.

To implement this aim we set ourselves the following tasks:

To make a brief analysis of the reactions that occur during plastination process.

To identify the physical and chemical factors that cause plastination reactions.

MATERIAL AND METHODS

In the Laboratory for plastination of anatomical preparations in Medical Faculty - Stara Zagora generally use a mixture of Biodur S10/S3 in ratio 99:1 and Biodur P40 (*BiodurTM, Heidelberg, Germany*).

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Methods that be apply are two. S10 plastination method is used mainly for plastination of internal organs in humans and animals.

With plastination P40 method are produced brain plates with high contrast between gray and white matter of the brain.

RESULTS

With the implementation of S10 plastination technique are received anatomical preparations with high quality and consistency preserved, but with changed color (darkening).

Brain plates made by P40 plastination method are 4 mm thick and are reserved details of brain structure.

DISCUSSION

According *Ulmer* (11) fixation is the key to good tissue preservation. The fixative causes a precipitation of the proteins in the body which is a **chemical process**, and stops the destruction of tissues by the enzymes and microorganisms in the human and animal body (4).

When we use a fixing with ethanol, the color of the biological material maintains, but there are not a difference between the anatomical elements - nerves, blood vessels. Fixed with ethyl alcohol anatomical preparations have not a sufficient resistance to mechanical stress. This complicates the processing of the biological material during the plastination process (1, 2). We use old formalin preparations and they give good results, which coincides with data published by other authors (7).

The process of dehydration was carried out similar to dehydration, which is made in the preparation of histological slides and can use the same dehydrators. The practical experience of many researchers in the field of plastination of anatomical objects is proved that one of the most suitable for dehydration is acetone (1, 6, 9). In conditions of low temperature (-25°C) acetone displaces the water from tissues and takes its place, which is a **physical process**. During this period, the water content of the dehydrating agent should not exceed 1%.

Forced impregnation is a **physical process**. An important condition in order to avoid shrinkage of preparations is the impregnation occurs slowly and gradually, as the acetone under vacuum evaporates quickly but S10 resin can not enter with the same speed at the place of acetone (10).

During the gas curing stage **chemical reaction** occurs between the components of impregnation mixture S10/S3 and hardener S6, where the resin cures (12).

The hardening in the production of brain plates P40 plastination method is a **chemical reaction** (polymerization), induced by a **physical factor** (UV-A with a wavelength of 315-400 nm).

CONCLUSIONS

1. Plastination process is a series of physical and chemical reactions, the combination of which arouse to the production of permanent anatomical preparations safe for human health.
2. Reactions constituting plastination process are caused by the action of physical or chemical factors.

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