

NATIONAL UNIVERSITY OF PHARMACY
DEPARTMENT OF PATHOLOGICAL PHYSIOLOGY

HYGIENE IN PHARMACY AND ECOLOGY

**«HYGIENE OF THE WATER AND WATER
SUPPLY. SANITARY REQUIREMENTS TO THE
WATER USED IN PHARMACY»**

KHARKIV, 2017/18

Plans of lectures

1. Physiological, economic, hygienic, epidemiological significance of water.
2. The concept of biogeochemical endemic.
3. Rationing the quality of drinking water in Ukraine.
4. Methods of water purification.
5. Methods of disinfecting water.
6. Hygienic requirements for water used in pharmacy.

The quastions of Independent work

1. Organization and conducting reconnaissance of water supply sources in emergencies and during the war. Assessment of water quality by field methods.
2. Organization and carrying out of sanitary supervision for cleaning, decontamination, decontamination of water in the field in emergency situations and during the war.

Suggested Reading

Basic

- Hygiene in Pharmacy. Manual for foreign students of higher schools / O. S. Kalyuzhnaya, O. P. Strilets, L. S. Strelnikov et al. – 2nd Edition, supplemented and revised. – Kharkiv: NUPh, 2013. – 224 p.
- Bardov V. G. Hygiene and Ecology/ Editer by V. G. Bardov. – Vinnytsya : Nova Knyha Publishers, 2009. – 687 p.

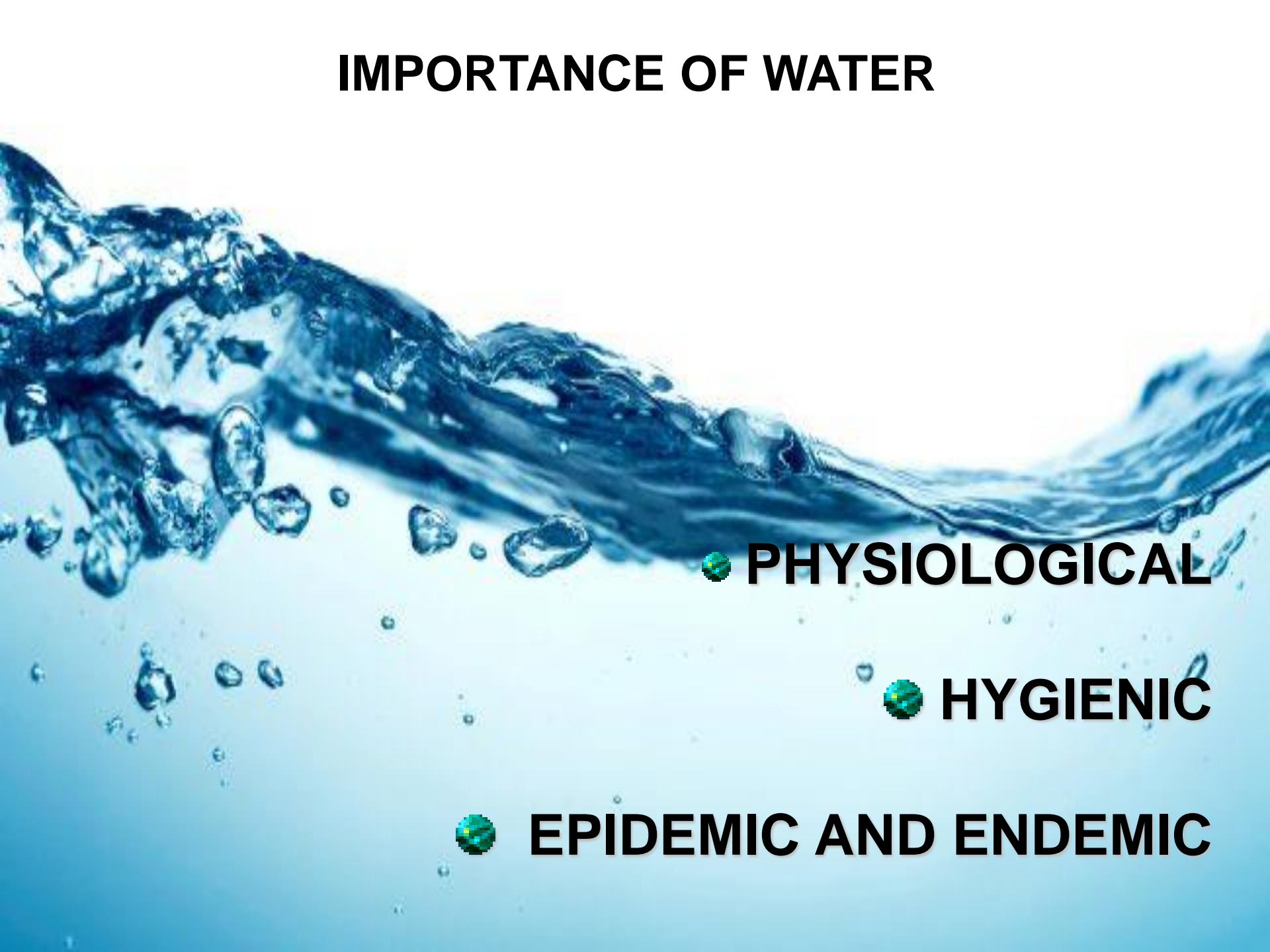
Auxiliary

- Kjellstrom Y. Basic environmental health / Y. Kjellstrom, K. Guidotti. – Oxford. – 2001. – 546 p.
- General Hygiene and environmental health / Zaporozhan V. M., Bazhora Yu. I., Vitenko I. S. et al. – Odessa, 2005. – 300 p.

Information resources, including the Internet

- 1. Library of NPhaU: <http://lib.nuph.edu.ua>
- 2. Specialized medical and biological portals of the Internet.

IMPORTANCE OF WATER



- PHYSIOLOGICAL
- HYGIENIC
- EPIDEMIC AND ENDEMIC

PHYSIOLOGICAL IMPORTANCE OF WATER

WATER CONTENT IN THE ORGANISM IS APPROXIMATELY 65% OF BODY WEIGHT.

ADULT'S DAILY BALANCE OF WATER IS 2,0 – 2,8 L.

WATER GETS IN THE ORGANISM WITH FOOD, DRINKS, AND EXUDES WITH URINE, FAECES, SWEAT, AIR.



WITHOUT WATER DEATH COMES IN 5 DAYS.

FATAL OUTCOME- the loss of 20 % of water

HYGIENIC IMPORTANCE OF WATER

■ PERSONAL HYGIENE

■ FOOD PREPARATION

■ LAUNDRY

■ CLEANNESS OF STREETS AND HOUSES

■ HYGIENE OF PHARMACEUTICAL AND MEDICAL PREVENTIVE AND TREATMENT INSTITUTIONS



HYGIENIC NORMS OF WATER USED FOR ONE PERSON ARE 350-400 LITERS A DAY

EPIDEMIC IMPORTANCE OF WATER

WATER TRANSFERS

**80% OF INFECTIONAL DISEASES IN THE WORLD
(CHOLERA, BELLY TYPHUS, DYSENTERY)**



HYGIENIC SIGNIFICANCE OF WATER CHEMICAL COMPOSITION

INEQUALITY OF WATER CHEMICAL COMPOSITION IS DETERMINED BY:

■ **NATURAL FACTORS**

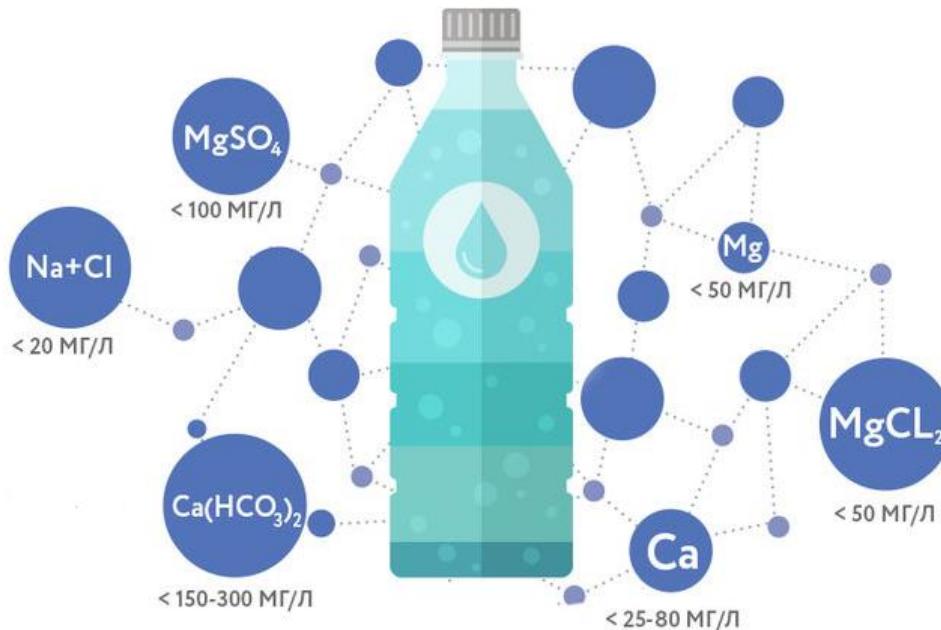
■ **ANTHROPOGENOUS FACTORS (AGRICULTURAL ACTIVITY AND INDUSTRIAL PROCESSES)**



HYGIENIC SIGNIFICANCE OF WATER CHEMICAL COMPOSITION

COMPOSITION OF WATER IS ONE OF THE MAIN REASONS OF POPULATION DISEASES:

- DEFICIENCY OR EXCESSIVE AMOUNT OF MICROELEMENTS, MINERAL SALTS
- PRESENCE OF BIOGENOUS ADDITION
- PRESENCE OF TOXIC ELEMENTS



MORE THAN 80 % OF FLUORINE COMES WITH WATER.

FLUORINE IS ESSENTIAL FOR ENAMEL AND BONE FORMATION

THE BEST POSSIBLE FLUORINE CONCENTRATION IS 0,7 – 1,5 mg/l.

FLUORINE

DEFICIENCY

ABUNDANCE

ENDEMIC
CARIES

ENDEMIC
FLUOROSIS

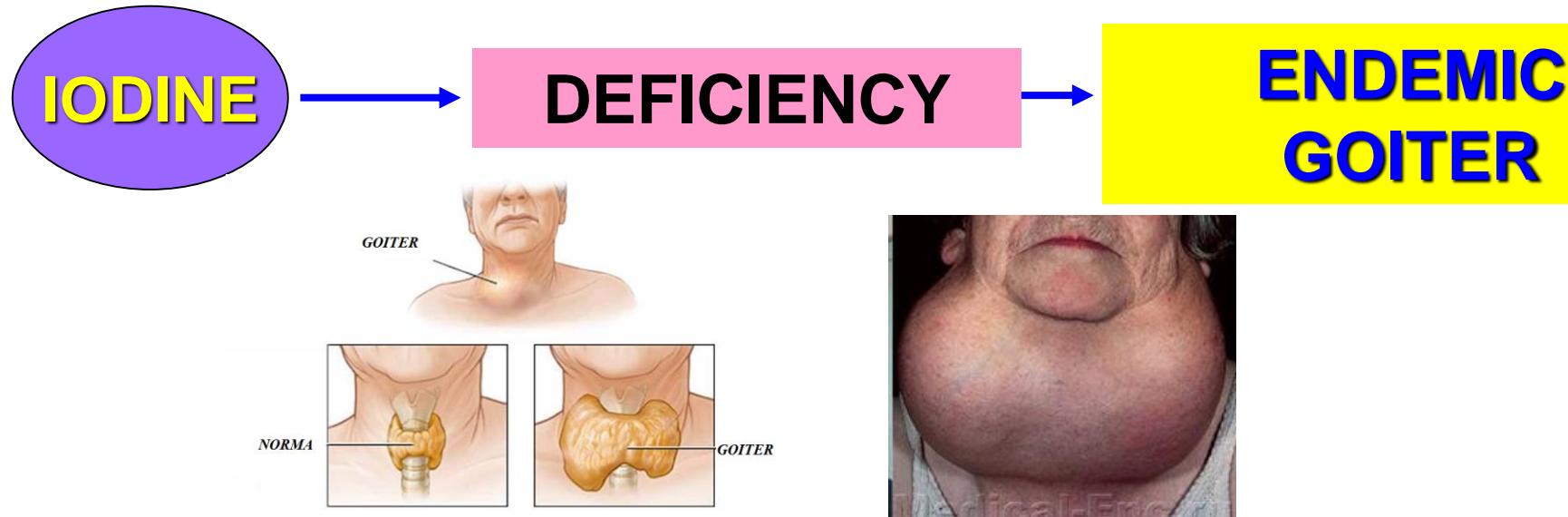


DAYLY BALANCE OF IODINE IS 120-200 mcg

IODINE SOURCES:

- 1. ORGANIC FOOD – 70 mcg;**
- 2. FOOD OF ANIMAL ORIGIN – 40 mcg;**
- 3. AIR – 5 mcg;**
- 4. WATER – 5 mcg**

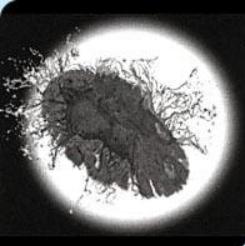
WATER DOES NOT COVER ALL THE NECESSETY OF ORGANISM IN IODINE, AS IN NATURAL FRESH WATER THERE IS APPROXIMATELY 0,003 – 0,0089 mg/l.





REQUIREMENTS TO DRINKING WATER

- 1. BE SAFE IN THE EPIDEMIOLOGICAL SENSE**
- 2. CLEAN IN CHEMICAL CONSTITUTION AND PHYSIOLOGICALLY FULL-RATE.**
- 3. HAVE GOOD ORGANOLEPTIC PROPERTIES**
- 4. SAFE RADIATION RATE**



MICROBIOLOGICAL INDEXES

- 1. THE TOTAL MICROBIAL COUNT** – not more than 100 CFU per 1 ml (CFU – COLONY-FORMING UNITS).
 - 2. THE NUMBER OF INTESTINAL BACTERIA (coliform)** – not more than 3 CFU/dm³(for centralized water supply), not more than 10 CFU/dm³(for decentralized water supply)
 - 3. THE NUMBER OF THERMOSTABLE INTESTINAL BACTERIA (FECAL COLIFORM)** – THERE MUST NOT BE CFU IN 100 sm³ OF WATER.
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- 1. THE NUMBER OF PATHOGENIC MICROORGANISMS** – MUST BE ABSENT IN 1 dm³ OF WATER.
 - 2. THE NUMBER OF COLIPHAGES** – MUST BE ABSENT IN 1 dm³ OF WATER.

ORGANOLEPTIC PROPERTIES OF WATER

- ODOUR
- TURBIDITY
- COLOUR
- TASTE AND AFTER-TASTE
- INDICATORS AFFECTING WATER ORGANOLEPTIC PROPERTIES (pH, total mineralization, total hardness, and al.)



***WATER OF DIFFERENT DEGREE OF CLEANNESS
IS USED IN PHARMACY:***

DESLTED (DEMINERALIZED)

PURIFIED (DISTILLED)

WATER FOR INJECTIONS



**DEMINERALIZED WATER IS
FREE OF CATIONS AND
ANIONS.**

**SUCH WATER IS USED TO
WASH GLASS, CAPSULES,
AUXILARY MATERIALS, TO
POWER DISTILLERS FOR
PURIFIED WATER AND WATER
FOR INJECTION RECEIVING.**



DISTILLED WATER IN PHARMACY IS OBTAINED IN AN EQUIPPED ROOM



DISTILLED WATER IS RECEIVED FROM DRINKING WATER.

The time of keeping purified water is 3 days

WATER FOR INJECTIONS IS USED FOR PREPARATION OF PARENTERAL SOLUTIONS, AND RESPONDS TO ALL REQUIREMENTS OF DISTILLED WATER.



WATER FOR INJECTIONS IS STERILE, PYROGEN-FREE.

WATER FOR INJECTIONS IS RECEIVED FROM DRINKING OR DISTILLED WATER.

SHELF LIFE IS NOT MORE THAN 24 HOURS OF RECEIPT AT THE TEMPERATURE OF 5-10°C OR 80-95°C.

WATER SUPPLY SYSTEMS

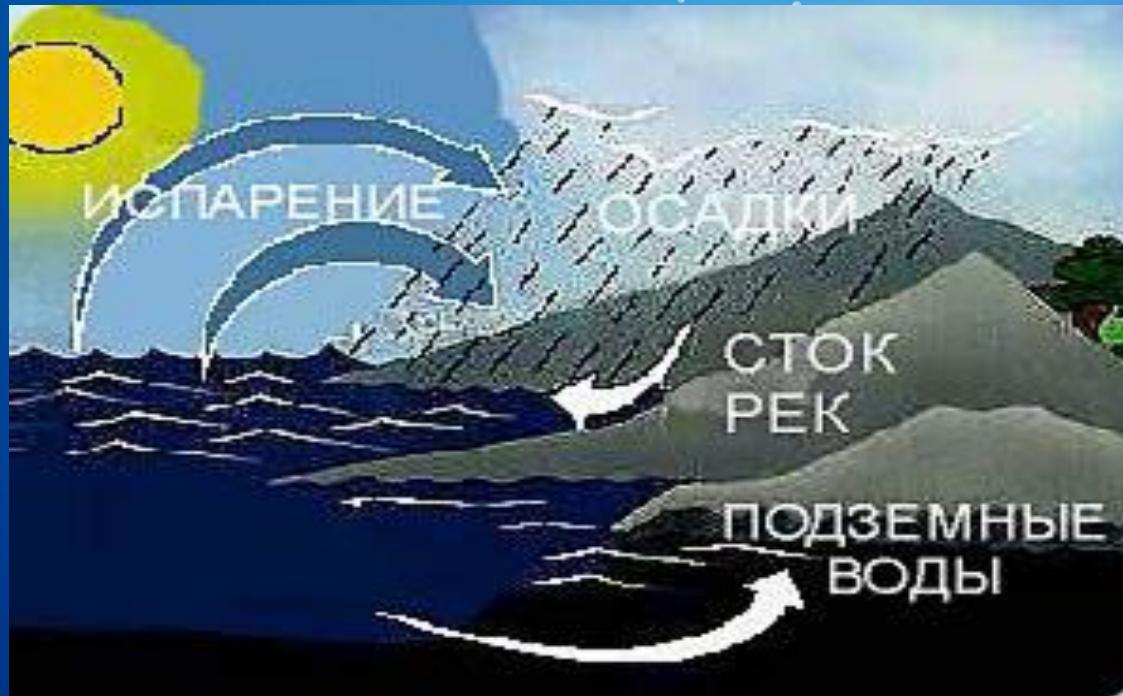
1) CENTRALIZED – WATER THAT IS SUPPLIED TO HOUSES AND INSTITUTIONS

2) DECENTRALIZED (LOCAL), WHEN CONSUMERS TAKE WATER DIRECTLY FROM WATER SOURCES



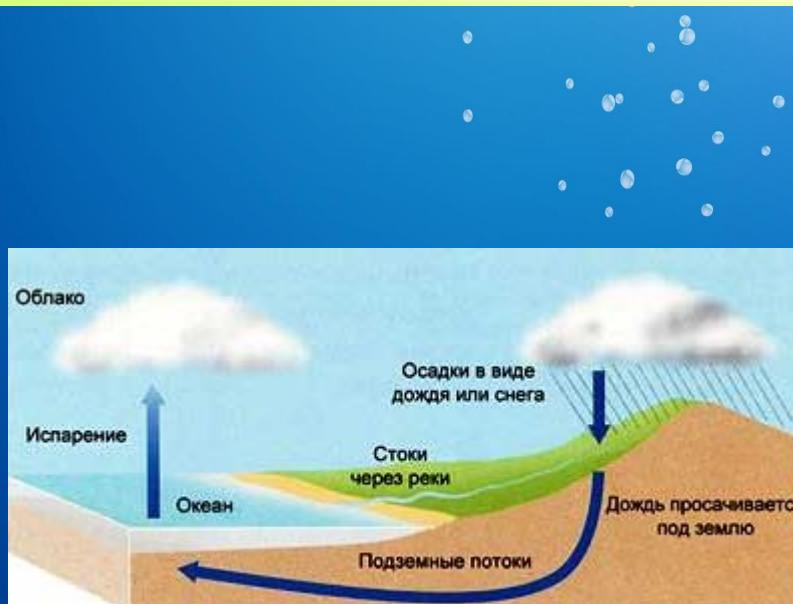
WATER SOURCES

1. ATMOSPHERIC WATER
2. UNDERGROUND WATER
3. OPEN RESERVOIRS



ATMOSPHERIC WATER

- IS FORMED WHEN WATER VAPOURS ARE THICKENED AND FALL TO THE GROUND AS RAIN OR SNOW
- ATMOSPHERIC WATER IS LOW-SALINITY, CONTAINS FEW ORGANIC SUBSTANCES, AND IS FREE OF PATHOGENOUS BACTERIA.
- AS SOURCES OF WATER SUPPLY ATMOSPHERIC PRECIPITATIONS ALMOST ARE NOT USED.



UNDERGROUND WATER

SOIL SUBTERRANEAN GROUNDWATER

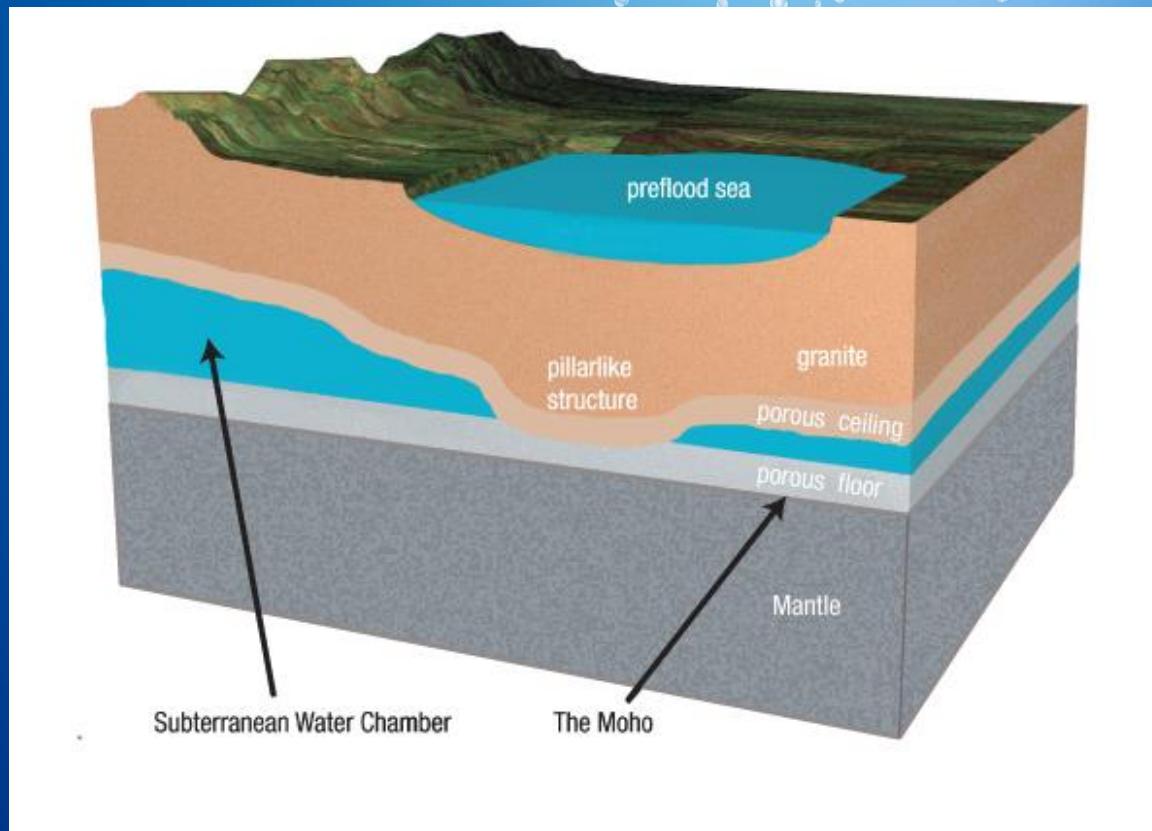
SOIL WATER IS CLOSE TO THE EARTH'S SURFACE

Its composition changes depending on hydrometeorological conditions. Soil waters are not stable because of evaporation intensity.



SUBTERRANEAN WATERS

SUBTERRANEAN WATERS ARE FORMED AS A RESULT OF PENETRATION OF ATMOSPHERIC PRECIPITATION THROUGH THE SOIL.

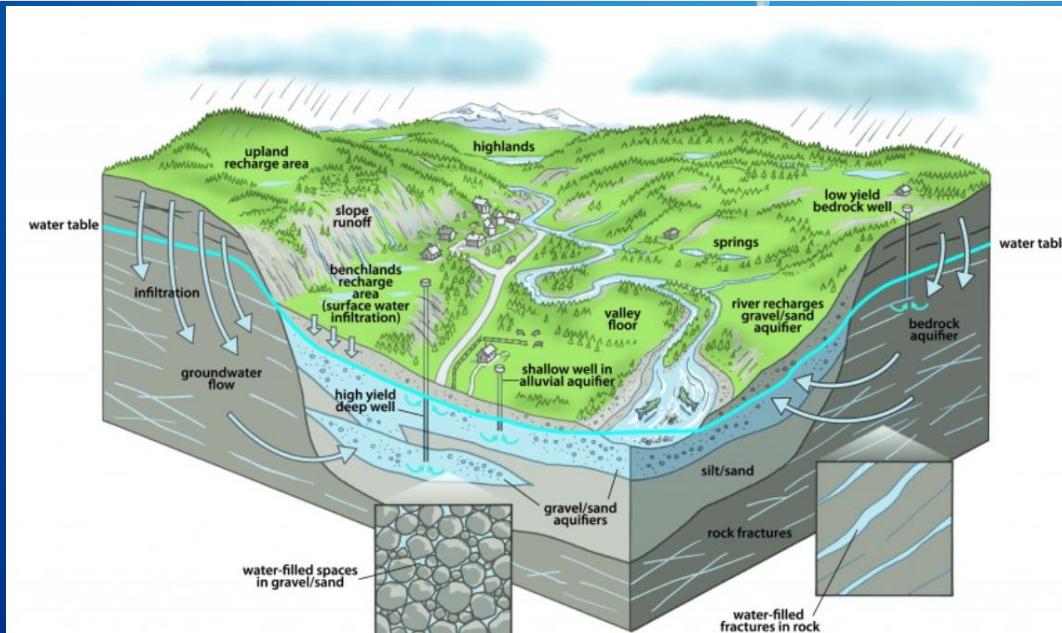


GROUNDWATER

GROUNDWATER IS WATER BETWEEN TWO WATER-IMPERVIOUS LAYERS. OCCURRENCE DEPTH- or VERY DEEP IN THE EARTH.

STEADY PHYSICAL PROPERTIES AND CHEMICAL COMPOSITION.

GROUNDWATER (ARTESIAN) IS NOT POLLUTED WITH MICROORGANISMS, AND IS USED WITHOUT DISINFECTION.



OPEN RESERVOIRS

**OPEN RESERVOIRS: NATURAL (RIVERS, LAKES) AND
MAN-MADE (WATER RESERVOIRS, CANALS).**

LIVE ON ATMOSPHERIC AND GROUND WATER.

**ALL WATER RESERVOIRS ARE POTENTIALLY
DANGEROUS**

**PURIFICATION AND DISINFECTION ARE PERFORMED
ON WATER SUPPLY PLANTS UNDER CONTROL OF
SANITARY EPIDEMIOLOGICAL SERVICE.**



METHODS OF PURIFICATION AND DECONTAMINATION OF DRINKING WATER

- 1. CLARIFICATION – ELIMINATION OF SUSPENDED MATERIALS**
- 2. DISCOLORATION – ELIMINATION OF COLOUR**
- 3. DISINFECTION – PURIFICATION OF WATER FROM MICROORGANISM**

COAGULATION IS THE FORMATION OF CONGLOMERATES, THAT PRECIPITATES ON THE BOTTOM UNDER THE ACTION OF COAGULUM.

COAGULUM IS ALUMINIUM AND FERRUM SALTS:
 $\text{Al}_2(\text{SO}_4)_3$, FeCl_3 .

ALONG WITH CONGLOMERATES 90% OF SUSPENDED PARTICLES AND APPROXIMATELY 99 % OF MICROORGANISMS ARE ELIMINATED.

METHODS OF WATER DISINFECTION

- 1. REAGENT – CHLORINE OR OZONE TREATMENT,
SILVER PROCESSING**
- 2. NON-REAGENT –UF, GAMMA RADIATION, US**
- 3. THERMAL – BOILING, STERILIZATION**



WATER CHLORINATION

GASEOUS CHLORINE, BLEACH, CALCIUM HYPOCHLORIDE, CHLORAMINES.

CLORINE DOSE MUST BE CALCULATED IN SUCH A WAY, THAT AFTER WATER DISINFECTION $0,3\text{-}0,5$ MG/DM 3 OF RESIDUAL CHLORINE WAS LEFT.

THIS AMOUNT OF CHLORINE PROVES THE RELIABILITY OF WATER DECONTAMINATION, AND DOES NOT WORSEN ORGANOLEPTIC



WATER OZONATION

WATER DECONTAMINATION HAPPENS QUICKLY

WITHOUT SMELL, TASTE, WITH **DISCOLORATION**

OZONE IS RECEIVED WHERE IT IS USED

**TO DECONTAMINATE WATER FROM 1 TO 4 MG/DM³ OF OZONE
IS NEEDED.**

DECONTAMINATION LASTS 10 MINUTES.



WATER DECONTAMINATION BY MEANS OF SILVER

- **SILVER CONCENTRATION OF 1 MG/DM³ COMPLETELY DECONTAMINATES WATER IN 2 HOURS.**
- **TORPID ACTION, PROLONGED EFFECT.**
- **SIMULTANEOUS USE OF CHLORIDE AND SILVER IS IMPOSSIBLE**



THERMAL METHODS OF WATER DISINFECTION

- **BOILING** –FOR SMALL AMOUNT OF WATER (TO BOIL 3-5 MIN.)
- **STERILIZATION** – WHEN THE TEMPERATURE IS MORE THAN 100°C .
- DEATH OF VEGETATIVE MICROORGANISMS.
- THEY ARE USED IN PHARMACY PRACTICE TO RECEIVE AQUA PRO INJECTIONS.

SPECIAL METHODS OF WATER DISINFECTION

WATER DEODORIZATION – MOVING OFF SMELL AND AFTER-TASTE

DESALINATION

DISTILLATION,
ELECTROLYSIS, HYPERFILTRATION.

METHOD,



SPECIAL METHODS OF WATER TREATMENT

DEGASING – MOVING OFF SOLUTED MALODOROUS GASES

SOFTENING–MOVING OFF Ca, Mg CATIONS

DEFERRIZATION – MOVING OFF Fe.

DESACTIVATION – MOVING OFF RADIOACTIVE SUBSTANCES

DEFLUORINATION – MOVING OFF EXCESSIVE AMOUNT OF F.

FLUORINATION – SATURATION BY F IF IT LACKS.



THANK YOU FOR ATTENTION!