|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| ACTIVITY PLAN | | | | |
| ACTIVITY PLAN | | | | |
|  | | | | |

|  |  |  |
| --- | --- | --- |
| **Theme** | **Subtopic** | **Activity Title** |
| 4. Collaboration and Communication in EcoSTEAM Projects | 4.2 Cross-disciplinary Collaboration for Sustainable Solutions | Determination the presence of starch in potatoes |

|  |
| --- |
| Introduction part (or activity overview) |
|  |

|  |  |
| --- | --- |
|  | |
| **Introduction part (or activity overview)** | Worldwide, the starch is the most common source of carbohydrates in the human diet and is found in large amounts in staple foods such as wheat, potatoes, maize, rice and cassava.  Students will have to prove the presence of starch in potatoes, as a significant source of energy support for the organism.  Starch is a plant polysaccharide, polymeric carbohydrate consisting of numerous glucose units joined by glycosidic bonds. This polysaccharide is produced by most green plants and is used as a energy storage, being found in the form of both amylose and the branched amylopectin.  Students will research the structure and presence of starch in potatoes, whose structural component is carbohydrates, or rather polysaccharides, they will calculate the required daily amount for the body and connect it to a healthy diet. |
| **SETTING** | Classroom and Laboratory |

|  |
| --- |
| Materials Needed |
|  |

|  |  |
| --- | --- |
|  | |
| **Materials Needed** | Potatoes, distilled water Lugal's solution - potassium iodide, colander, mixer, cups, funnel, erlenmeyer, filter paper, a glass rod, test tube, pipettes, computer or phone, microscope. |

|  |
| --- |
|  |
|  |

|  |  |  |
| --- | --- | --- |
|  |  |  |
| **Learning Outcomes** | * Learn about the structure and characteristics of starch, carbohydrates, polysaccharides * Identify the presence of starch in potatoes through an experimental activity * Develop communication skills and discuss about healthy food * Collaborate with the group in research and demonstration * Calculate the required amount of carbohydrates on a daily basis |  |
| **Activity Contents** | **Activity 1: Investigation of starch structure**  **Theoretical Part (Duration: 35 minutes):** Introductory discussion. Discussion about polysaccharides and describing their characteristics.  **Task (Duration: 35 minutes):** **Observing** **starch grains : molecules of amylose and amylopectin**  Step 1: Work in groups  Оne group will investigate the properties and structure of polysaccharides.  Polysacharides are high molecular compounds whose molecules are built from a large number of monosaccharide units. Polysaccharides made of different monosacharides are called heteropolysacharides, and those made of the same monosacharides are called homopolysacharides.  Polysaccharides or polycarbohydrates contain more than ten monosaccharide units, and often several hundreds or thousands of monosaccharide units. Тhe linkage between monosaccharide units in polysaccharides occurs through O-glycosidic bonds. Тhat is why they are called glycans. Polysaccharides are an important class of biological polymers. Their function in living organisms is usually either structure- or storage-related. Storage polysaccharides are starch, glycogen, galactogen and inulin. Structural polysaccharides are arabinoxylans, cellulose, chitin and pectins. Glycogen's properties allow it to be metabolized more quickly, which suits the active lives of moving animals. In bacteria, they play an important role in bacterial multicellularity.  Step 2: Тhe other group will investigate the properties and structure of starch grains associate it with a group of polysaccharides, using a microscope, in order to identify the structure of amylose and amylopectin.  Starch grains contain at least two different types of molecules. These are amylose and amylopectin. Starch grains are insoluble in water and give a blue color to the amylose chain. Starch grains can have different shapes and sizes.  In amylopectin, a large number of glucose molecules are interconnected so that its structure resembles a branch with many long and short branches. Amylopectin does not give a blue color with Lugal's solution because the branched molecules cannot be coiled into a helix.  In amylose, a large number of glucose molecules, over 200, are interconnected in a long unbranched chain. In nature this chain is coiled in a spiral. Amylose consists of linear and unbranched chains of several thousand glucose units. These units are linked by a glycosidic bond between their first and fourth carbon atoms. Amylose in the human and animal organism is hydrolytically broken down under the action of the amylase enzyme. The disaccharide maltose is obtained.  **Activity 2: Chemical Composition of the Starch**  **Theoretical Part (Duration: 10 minutes):** Introductory discussion about the properties of pure starch.  Pure starch is a white, tasteless and odorless powder that is insoluble in cold water or alcohol. In industry, starch is converted into sugars, for example by malting, and fermented to produce ethanol in the manufacture of beer and whisky.  **Workflow: Isolate the starch from the corn (Duration: 45 minutes):**  Chop the potatoes with distilled water and a mixer, let the glass stand for a while the starch grains did not settle, filtered them, put the starch in a test tube, add Lugol solution with a pipette and got a blue coloring.  Lugal solution - Lugal's iodine, also known as aqueous iodine and strong iodine solution, is a solution of potassium iodide with iodine in water.It is a medication and disinfectant used for a number of purposes.  **Workflow:** Determine the starch in potatoes using reagents **(Duration: 30 minutes):**  Add a solution of potassium iodide to the starch solution, a blue coloration is obtained. It is a characteristic reaction that proves the presence of starch. The blue color is due to the insertion of triiodide ions I3 into the amylose chain. This reaction serves for the identification of starch, but also of iodine and finds application in analytical chemistry.  Video : https://www.youtube.com/watch?v=SgDeHXWm8Hk  Duration : Approx. 1min 34sec.  Overview : This video shows how to test food for the presence of Starch. A blue/black colour would indicate that starch was present in the food ( Iodine test for starch ).  **Task (Duration: 45 minutes):** **Testing the** **effect of temperature on amylase**  Step 1: Six test tubes are required. Mark each of them with a number.  In three of them eg. 1,2 and 3 put 5 cm3 of 1% starch solution and then add 6 drops of iodine solution to each of them. In the next three test tubes 4, 5 and 6 put the same amount of amylase (Appendix 4).  Step 2: Prepare three water baths (jars with the same amount of water).  Add ice to the first jar. In the second jar, the water should be room temperature - about 20 degrees. The third jar should have hot water around 35 degrees.  Place test tubes 1 and 4 in the first jar, 2 and 5 in the second, and 3 and 6 in the third.  Mix the test tubes that are in the same jar into each other  Step 3: Observe what is happening. Each test tube in each of the jars has a blue colored solution because starch turns blue in the presence of iodine. But gradually the blue color will start to disappear. Why? Amylase is an enzyme that breaks down starch and will break down the iodine-starch complex. This process will take place the fastest in hot water, but if you were to place such a test tube in hot water, because amylase is an enzyme - protein composition, it will be destroyed at high temperature and will not work.  **Task ( Duration : 30 min ): Еnergy and nutritional value of carbohydrates**    Step 1: Students research the nutritional value of potatoes, working in groups :  How much energy and nutrients does 100 g of potatoes contain?  Energy value 76 kcal / 319 kcal  Carbohydrates 16 g  Protein 2 g  Fats : 0,1 g  Fiber 2 g  Step 2: Mathematical calculation the required daily amounts of carbohydrates in the body, working in groups:  To calculate the necessary intake of carbohydrates in the body is by using several different methods, depending on goals, physical activity, health conditions and individual needs:  Based on energy expenditure: One way to calculate the need for carbohydrates is based on energy expenditure. If there is physical activity, the body may require more carbohydrates to maintain energy levels. The recommended amount of carbohydrates for active people usually ranges between 45% and 65% of total energy intake.  Individual Needs: Individual carbohydrate needs can vary depending on many factors, such as age, gender, weight, metabolism, health conditions and goals. Some people may have higher carbohydrate needs, especially if they are in a phase of growth, development or heavy physical training.  Calorie intake: Carbohydrates contain 4 calories per gram. To calculate how many carbs you need, calculate daily calories and choose what percentage of those calories to come from carbs.  Example:  If the daily caloric intake is 2000 calories.  50% of the calories come from carbohydrates, that would be 1000 calories.  Therefore, to calculate how many grams of carbohydrates you need, divide the number of calories from carbohydrates by 4 (the number of calories per gram).  Example:  1000 calories from carbs / 4 = 250 grams of carbs  This is just one example of calculating the need for carbohydrates. It is always important to consult a health professional or dietitian to determine individual food intake.  Step 3 : Students summarize about the role of carbohydrates as one of the three basic macronutrients, an important role in nutrition. They are the basic source of energy and many vital processes in the body function. However, in order to use them to your advantage as much as possible, you must make sure that you choose them correctly. The majority of carbohydrate-containing foods should be those that contain complex carbohydrates and at the same time are rich in fiber, i.e. products from whole grains, legumes and vegetables, reducing food with a high content of simple sugars.  Carbohydrates should make up approximately 45-60% of our total daily energy intake. With an energy intake of 2000 kcal, this represents 225-300 g of carbohydrates. This amount is recommended by the European Food Safety Agency (EFSA). Potatoes are an excellent source of carbohydrates, potassium, fiber, and even vitamin C, with only 16 g carbohydrates/100 g on average. |  |
| **Assessments** | The individual activities specified in the task sheet are evaluated with points.  The evaluation and self-assessment of the group work are conducted by the students themselves. |  |
| **Key Competences** | Cognitive competence  Creativity competence  Communication competence  Social, emotional and healthy living competences  Digital competence |  |
| **Connections with Eco STEAM** | **E**co - realize that plant food is a source of nutritional ingredients, necessary for bio-chemical processes in cells, tissues and the body as a whole.  **S**cience - connect knowledge from chemistry and biology.  **T**echnology – search with digital technologies  **E**ngineering – use a microscope as a modern model  **A**rt - draw the structure of amylose and amylopectin.  **M**athematics - calculate the required daily amount of carbohydrates for the normal functioning of the body |  |
| **References** | <https://www.youtube.com/watch?v=SgDeHXWm8Hk>  https://www.sciencedirect.com/science/article/pii/S0168945222000474 |  |
| **Notes** | Location : Chemistry cabinet in our school  76732968_2604179009675389_4534396286639538176_n.jpg Отвори фотографија C:\Users\Dell-PC\Downloads\77225077_424141501591806_6742969058376810496_n.jpg  Isolation of potato starch and filtration of the mixture  77343804_479176836027238_5567663653102026752_n.jpg Отвори фотографија  Poving the presence of starch in the potato mixture |  |
|  |  |  |

|  |
| --- |
|  |

**Determination structure of starch granules**

**Structure of amylose Structure of amylopectin**

Evaluation (1 point for preparing the micro-preparation; 1 point for finding the microscopic image; 1 point for the drawing)

**EVALUATION TABLE**

|  |  |
| --- | --- |
| Evaluated Activities | Points |
| Demonstration an experimental activity | \_\_/5 |
| Proper use of chemicals | \_\_/4 |
| Determination of starch in potatoe with the necessary reagents | \_\_/3 |
| Microscopy of starch granules | \_\_/3 |
| Mathematical calculation the required daily amounts of carbohydrates in the body | \_\_/3 |

# GROUP WORK SELF-ASSESSMENT

|  |  |
| --- | --- |
| Self-Assessment Criteria | Points |
| Ability to use digital technologies for information search | \_\_/5 |
| Ability to work in a group (discuss, listen to different opinions) | \_\_/5 |
| Ability to generate ideas, suggest solutions | \_\_/5 |