THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

155/3 **FOOD AND HUMAN NUTRITION 3**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2009**

Instructions

1. This paper consists of sections **three (3)** questions
2. Answer all questions
3. Question **one (1)** carries **twenty (20)** marks and question **two (2)** and **three (3)** carries **fifteen (15)** marks each.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. You are provided with **cassava flour**. You are required to perform the experiment by following the given procedures I to VII.

Procedure I

Place 25 g of cassava flour and 15 ml of clean tap water in a small bowl and mix thoroughly.

Procedure II

Knead the mixture by hand for 5 minutes. Add a little more flour if the mixture is too wet and a little more water if it is tough and crumbly. Observe the characteristics of the mixture and give explanations.

Answer

When the cassava flour is kneaded with water, it initially forms a sticky, slightly cohesive mixture. The texture depends on the ratio of water to flour. If too much water is added, the mixture becomes wet and sticky, making it difficult to shape; this happens because water hydrates the starch granules, causing them to swell and form a gel-like network. If too little water is added, the mixture becomes dry and crumbly because the starch granules cannot swell sufficiently, preventing proper binding.

(a) Two other factors that could have resulted in the characteristics observed in Procedure II include the particle size of the cassava flour and the temperature of the water. Fine flour absorbs water more evenly, producing a smoother dough, while coarse flour may result in a lumpy texture. Warm water helps starch gelatinization, improving dough elasticity, whereas cold water slows the process, making it less cohesive.

Procedure III

Knead the mixture until a smooth ball of dough that springs back to the touch is obtained.

Answer

During kneading, the dough develops elasticity as starch granules absorb water and interact, forming a cohesive network. This network allows the dough to stretch and return to shape when pressed, indicating proper hydration and kneading.

Procedure IV

Cover the dough with clean tap water and soak it for 10 minutes.

(b) The dough was soaked in water to allow further hydration and partial leaching of soluble components such as starch. Soaking softens the dough, making it easier to manipulate in later procedures, and helps separate the pure starchy substance (substance Q) from other soluble materials.

Procedure V

Work on the dough using fingers. Pour some of the washing water into a clean beaker and allow it to stand for 15 minutes while observing. Record your observations and give explanations.

Answer

After standing, the washing water becomes cloudy due to the suspended starch particles. The heavier starch gradually settles at the bottom, while the water on top remains slightly milky. This demonstrates the separation of starch from the soluble components of the cassava dough.

Procedure VI

Replace with fresh water, discarding the washing water, until a more elastic substance Q is formed during the washing process. Strain the washing water to collect scattered pieces of substance Q. Observe the colour of the water and give explanations.

Answer

The washing water appears slightly cloudy initially but becomes clearer with repeated washing, indicating that most soluble impurities have been removed. Substance Q is the elastic starch mass, which appears white and sticky. The repeated washing isolates this pure starch from the rest of the dough.

Procedure VII

Place substance Q in a petri dish and identify it.

(c) (i) When cassava flour and water were mixed and kneaded, starch granules absorbed water and formed a sticky, cohesive dough. Mechanical action helped distribute water evenly and partially gelatinized the starch.

(ii) The role of starch in the baking process is to provide structure and texture. When heated, starch gelatinizes, trapping water and forming a firm yet flexible network, which gives baked goods their desired consistency.

(iii) The purpose of forming substance Q in the baking process is to obtain pure starch, which contributes to dough elasticity, water retention, and improves the texture of the final baked product.

2. You are provided with **fresh goat milk, vinegar, concentrated nitric acid (HNO3), lime water, ammonium solution, and red litmus paper**. Perform three experiments by following the procedures given under each experiment. Record observations and provide explanations.

Procedure A

(i) Place 20 ml of milk into a clean, dry test tube.

(ii) Add 2 ml of vinegar and allow the mixture to stand for 5 minutes. Write observations and give explanations.

(iii) Separate the contents of the mixture.

Answer

When vinegar is added to milk, it curdles, forming solid white curds and leaving a yellowish liquid (whey). This occurs because the acid lowers the pH, causing casein proteins to coagulate and separate from the liquid.

(a) The components of milk obtained after standing are solid curds (casein) and liquid whey.

(b) Vinegar is acidic in nature and acts as a coagulant, causing the milk proteins to precipitate.

Procedure B

Divide the fluid portion of the mixture obtained in Procedure A into two equal portions, then:

(i) Heat one portion in a porcelain dish over a flame. Record observations on changes.

(ii) Evaporate the other portion almost to dryness in a water bath, allow to cool, and observe the odour and taste of the residue.

Answer

(i) On heating the whey, slight thickening occurs, and proteins may denature further, sometimes leaving a thin layer of film on the surface.

(ii) On evaporation, the residue becomes concentrated, showing a slightly sweet taste due to lactose and a characteristic milky odour.

Question

Procedure B demonstrates that milk contains soluble proteins (whey proteins) and lactose. Heating denatures proteins, and evaporation concentrates sugars and minerals, showing milk's composition.

Procedure C

Dry the thick substance obtained in Procedure A on filter paper and divide it into three equal portions:
(i) Place one portion on a porcelain dish and heat it on a flame. Observe the odour of the fumes and give explanations.
(ii) Place the second portion into a dry test tube, cover it with 10% lime water, and gently warm. Observe the odour and test with moist red litmus paper. Record observations.
(iii) Place the third portion in a dry test tube, carefully cover with concentrated nitric acid, heat to boil while observing, cool under running water, and slowly add ammonium solution. Record observations.

Answer

(ii) Lime water reacts with ammonia released from protein decomposition, turning the solution slightly cloudy and indicating the presence of nitrogen compounds. Red litmus paper turns blue, showing alkalinity.

(iii) Nitric acid reacts with proteins, forming a yellow compound (xanthoproteic reaction), confirming aromatic amino acids. Adding ammonium solution produces further reactions showing protein composition.

3. You are provided with **sample P (taro root)** and **iodine solution**. Perform the experiment by following Procedures I to V. Record observations and give inferences.

Procedures:

(i) Peel, wash, and cut the food sample into two equal pieces using a clean knife.
(ii) Place one piece in a clean petri dish and cook the other piece in boiling water for 15 minutes.
(iii) Remove the boiled piece, place it in another petri dish, observe its odour, and record observations with explanations.
(iv) Mash both pieces using a teaspoon. Record observations and give explanations.
(v) Half-fill a test tube with the water used to boil the sample and add a few drops of iodine solution. Record your observation and give explanations.

Answer

(iii) The boiled taro root has a soft texture and a slightly sweet earthy odour due to the breakdown of starch and volatile compounds.

(iv) Mashing the raw taro shows a firm, starchy paste, while the boiled taro forms a smooth, sticky paste. The difference is due to gelatinization of starch on heating, making the texture softer and cohesive.

(v) When iodine solution is added to the boiling water, a blue-black colour appears, indicating the presence of starch that leached from the taro root into the water.