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## DEPARTMENT OF PHYSICS

# EFFECTS OF IMPURUTIES ON THE HEAT ABSORPTION AND RETENTION CAPACITY OF FRESHWATER

# A CASE STUDY OF BISINA LAKE IN AGULE PARISH, KUMI DISTRICT

**BY**

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**A RESEARCH REPORT SUBMITTED TO THE FACULTY OF SCIENCE AND EDUCATION DEPARTMENT OF PHYSICS IN PARTIAL FULFILMENT OF THE REQUIREMENTS LEADING TO THE AWARD OF A BACHELORS DEGREE IN SCIENCE AND EDUCATION OF BUSITEMA UNIVERSITY**

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## DECLARATION

I Opolot Timothy, hereby declare that this research proposal is my original work and that it has never been submitted to any institution for an academic award.

**Signed** ..... **Date**..27th/04/2023.....

**Opolot Timothy**

## APPROVAL

This research proposal has been prepared under my supervision upon appointment by Busitema University.

**Signed.** ..... **Date**28/04/2023

**Dr. Andima Geoffrey (PhD)**

## DEDICATION

This research is dedicated to the Almighty God for the love, financial support, divine protection, health, direction and mercy from the time of birth up to date and forever Amen.

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**ABSTRACT**

The effect of impurities on the heat retention and absorption of freshwater was investigated with a view on identifying which impurity gave freshwater the best heat retention and absorption ability. The effect of concentrations of impurities on the heat absorption and retention capacity of water was also investigated. Two methods were used each for the determination of both heat retention and absorption of freshwater. Measured values (10g, 20g and 30g) of sugar samples was dissolved in a 100ml polypropylene beaker of water and kept in a freezer simultaneously till the solutions attained freezing point, with the temperature drop recorded at intervals of fifteen minutes with a digital thermometer. The beakers were removed simultaneously from the freezer with the temperature rise recorded till room temperature was attained. Measured values (10g, 20g and 30g) of sugar were each added to 100ml of water, and the solution heated to boiling point. This was done for samples of Salt. Time taken for each sample to reach boiling point was also recorded. A cooling system was setup with the aid of a copper calorimeter and stirrer, to enable uniform temperature during the cooling process. A digital thermometer was used to record temperature drop at each fifteen-minute interval till room temperature was attained. Graph of temperature against time was plotted using Microsoft Excel Spreadsheet, in which the rate of heat retention and absorption of impurity solutions and freshwater was determined. The results showed that salt water has the highest capacity to retain and absorb more heat than sugar water and fresh water respectively, and generally the concentration of impurities in solution also determines the rate of heat retention and absorption ability.

# CHAPTER ONE

# INTRODUCTION

## 1.0 Introduction

Water is a transparent fluid that forms the world's streams, rivers, lakes, rain, and oceans. As a chemical compound, a single water molecule contains one atom of oxygen and two atoms of hydrogen connected by covalent bonds (Pullman et al,1985) except heavy water deuterium oxide ($2H_2O$) which is a form of water that contains a larger than normal amount of the hydrogen isotope deuterium. Most liquids boil at temperatures at which their vapour pressure is equal to the pressure of the gases above them (Goldberg, 1988).

The vapour pressure of the solution is always less than the vapour pressure of the solvent for a non-volatile solute. A higher temperature is therefore required for the vapour pressure to reach the surrounding pressure such that the boiling point is elevated. The boiling point elevation which is a colligative property is an effect of the dilution of the solvent in the presence of a solute. It is a phenomenon that happens to all solutes in all solutions and is independent of solute-solvent interactions. The increase in boiling point occurs both when the solute is an electrolyte and a nonelectrolyte. The origin of the boiling point elevation is entropic that can be described in respect of the vapour pressure or chemical potential of the solvent (Atkins, 1994).

A substance is changed from its liquid state to a solid state when its temperature is lowered below its freezing point. The presence of an additive in a liquid can lower the freezing point of the liquid, this phenomenon is referred to as freezing point depression. At the freezing point of a solvent, the chemical potential of the solution at the liquid state and solid state will be equal. Addition of solute to the solvent will reduce the chemical potential of the solution and consequently, its freezing point (Atkins, 1994).

## 1.1 Background of the project

Heat is a central concept in thermodynamics and statistical mechanics and is also important in chemistry, engineering, and other disciplines (Gould and Tobochnik, 2010). Heat capacity is the measurable physical quantity that characterizes the amount of heat required to change a body's temperature by a given amount. Camilloni and Barros (1997) defined heat capacity as an extensive property of matter that is dependent on the size of a system, which could be expressed as derived quantities that specify heat capacity as an intensive property that is independent of the size or extent of a sample (Lynden-Bell, 1998).

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