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DETERMINATION OF HEAT OF NEUTRALIZATION OF ACIDS PRESENT IN FRESH VEGETABLE JUICES-RIGDE GOURD

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ABSTRACT

Determination of heat of neutralization has been determined for fresh vegetable or fruit juices for finding whether the juice is strong electrolyte or weak and whether the juice is acidic or basic in nature. There are two types of electrolyte weak and strong. The study is based on the theory of heat of neutralization which is the heat release when 1 gram equivalent of acid neutralised by a base or wise versa. The heat of neutralization is pH dependent which shows the acidity and basicity of the substance. Neutralization process is generally exothermic in nature. Heat of neutralization is known as Enthalpy of neutralization and has a unit KJ/mol. Juices plays an important role in human health.

KEYWORDS: Neutralization, electrolyte, Enthalpy, Juice and Health.

INTRODUCTION

Heat of Neutralization

The enthalpy of neutralization (ΔHn) is the change in enthalpy that occurs when one gram equivalent of an acid or a base undergo a neutralization reaction to form water and a salt. It is a special case of the enthalpy of reaction. It is defined as the energy released with the formation of 1 mole of water.

When a strong acid HA, reacts with a strong base, BOH, the reaction that occurs is

$$H^+ + OH^- \longrightarrow H_2O$$

as the acid and the base are fully dissociated and neither the cation B+ nor the anion A− are involved in the neutralization reaction. The enthalpy change for this reaction is -57.62 kJ/mol at 25 °C.

For weak acids or bases, the heat of neutralization is pH-dependent.[1] In the absence of any added mineral acid or alkali some heat is required for complete dissociation. The total heat evolved during neutralization will be smaller.

$$\mathrm{HCN} + \mathrm{NaOH} \longrightarrow \mathrm{NaCN} + \mathrm{H_2O};\ \Delta H = -12\mathrm{kJ/mol}$$

When a reaction is carried out under Standard Condition at the temperature of 298 K (25 degrees Celsius) and 1atm of pressure and one mole of water is formed it is called the *standard enthalpy of neutralization* ($\Delta H_n^{\ominus}$).

$$Q = mc_p\Delta T$$

Where m is the mass of the solution, c_p is the specific heat capacity of the solution, and ΔT is the temperature change observed during the reaction. From this, the standard enthalpy change (ΔH) is obtained by division with the amount of substance (in moles) involved.

$$\Delta H = -\frac{Q}{n}$$

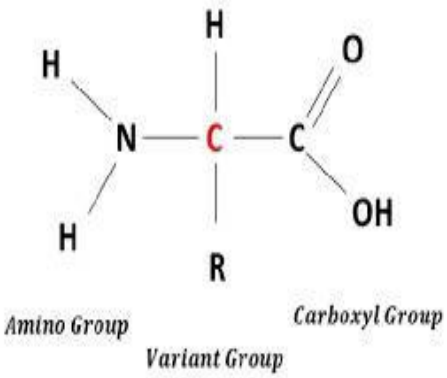
Acids Present in rigde Gourd

Five phenolic acids including palmitic acid, p-coumaric acid, stearic acid and myristic acid and two flavanols.

Namely catechin and quercetin were determined and quantified by HPLC. For quantitative validation by HPLC, Individual phenolic acids were collected and spiked with known concentration of standard. p-coumaric acid, gallic acid, and protocatechuic acid are the main phenolic acids present in LAP. In free form, p-coumaric acid (68.64 ± 1.46 mg/100 g dw)

shows highest concentration followed by gallic acid (34.98 ± 1.89 mg/100 g dw), protocatechuic acid.

AMINO ACID:- Amino acids are organic compounds composed of nitrogen, carbon, hydrogen and oxygen, along with a variable side chain group. Your body needs 20 different amino acids to grow and function properly. Though all 20 of these are important for your health, only nine amino acids are classified as essential.



A Amino acids, often referred to as the building blocks of proteins, are compounds that play many critical roles in your body. They're needed for vital processes like the building of proteins and synthesis of hormones and neurotransmitters. Some may also be taken in supplement form for a natural way to boost athletic performance or improve mood. They're categorized as essential, conditionally essential or nonessential depending on several factors. This article tells you everything you need to know about essential amino acids, including how they function, possible food sources and the benefits of taking a supplement.

NaOH is Used as a Strong Base

NaOH is the strong base because it completely dissociates in an aqueous solution to give OH^- ion and no miles of it remain undissociated inside the solution. Sodium hydroxide is also known as soda lime has the chemical formula NaOH. It is made up of Na+ cation and OH- anion. It is mainly used for manufacturing soaps, detergents, and paper.

LITERATURE REVIEW

A multitechnique approach in protein/surfactant interaction study: physicochemical aspects of sodium dodecyl sulfate in the presence of trypsin in aqueous medium was studied and observed by S.Ghosh and coworkers.[1] Early complement components enhance neutralization of Chlamydtrachomatis infectivity by human sera was studied by JS Lin and cowerkers.[2]

The Application of the Theory of Absolute Reaction Rates of Proteins was studied by H Eyring and coworkers.[3]

Human Passive Transfer Antibody: II. Neutralization of Antigen was studied by WM SCHMIDT and coworkers.[4] Neutralization Assay for Human Group C was studied by MY Ogura and coworkers.[5] Neutralization Process of Acid: Design of the Sampling System, Miravalles Geothermal Field, Costa Rica was studied by FN Solano and coworkers.[6]

Antibody-mediated neutralization of flaviviruses: a reductionist view was studied by KA Dowd and coworkers.[7] Vaccinia virus complement-control protein prevents antibody-dependent complement-enhanced neutralization of infectivity and contributes to virulence was studied by SN Isaacs and coworkers.[8] Workshop on In Vitro Neutralization of Chlamydia trachomatis: Summary of Proceedings was studied by GL Byrne and coworkers.[9]

Intracellular sensing of complement C3 activates cell autonomous Nour immunity was studied by JCH Tam and coworkers.[10] In-situ acid neutralization system solves facility upset problems was studied by EB Greene and coworkers.[11] Endotoxin neutralization as a biomonitor for inflammatory bowel disease was studied by K Champion and coworkers.[12]

Effects of ultrafast heating and gaseous chlorine on the neutralization of bacterial spores was studied by W Zhou and coworkers.[13] Antibody-independent neutralization of vesicular stomatitis virus by human complement: I. Complement requirements was studied by BJ Mills and coworkers.[14] Neutralization was studied by DR Erickson and coworkers.[15]

Neutralization of Bridge blood anticoagulant was studied by F Synergistic Nour-Eldin-Nature and coworkers.[16] Self-dissociation and protonic charge transport in water was studied by M Eigen coworkers.[17] Immunological Cross-Reactivity Between a Heat-Labile Enterotoxin(s) of Escherichia coli and Subunits of Vibrio Cholera Enterotoxin was studied by was studied by JD Clements and coworkers.[18]

Flue gas neutralization by adding gaseous ammonia was studied by M Maekipaeae and coworkers.[19] Differences in the Response of Rabbit Small Intestine to Heat-Labile and Heat-Stable Enterotoxins of Escherichia coli was studied by DG Evans and coworkers.[20] Analysis of the Joint High Energy Solid State Laser for Neutralization of Mortar Rounds in Flight was studied by LTCL Florence and coworkers.[21]

Improving neutralization potency and breadth by combining broadly reactive HIV-1 antibodies targeting major neutralization epitopes was studied by R Kong and coworkers.[22] Neutralization and enhancement of infectivity of non-salmonid fish rhabdoviruses by rabbit and pike immune sera JPM Clerx and coworkers.[23] Heat stroke and cytokines was studied by LR Leon and coworkers.[24]

Panels of HIV-1 subtype C Env reference strains for standardized neutralization assessments was studied by P Hraber and coworkers.[25] Corrosive ingestion: The evidence base. Controversy in dilution and neutralization therapy was studied by D Pelclova And coworkers.[26] Novel mechanism of antibody-independent complement neutralization of herpes simplex virus type 1 was studied by HM Friedman and coworkers.[27]

Broad neutralization by a combination of antibodies recognizing the CD4 binding site and a new conformational epitope on the HIV-1 envelope protein was studied by F Klein and coworkers.[28] Role of complement in neutralization of respiratory syncytial virus was studied by SM Yoder and coworkers.[29] Effects of feeding heat-treated colostrum on passive transfer of immune and nutritional parameters neonatal dairy calves was studied by JL Johnson and coworkers.[30]

MATERIAL AND METHODOLOGY

Thermas/calorimeter Beeker, Wide polythene bottle, Rubber cork Thermometer, Stirrer fitted with a cork, Measuring cylinder, 1N Sodium hydroxide solution, Burner, Cold water at room temperature, □ lass rod, Vegetable juices (Ridge Gourd).

Apparatus Setup

METHODOLOGY

Procedure:- For Water Equivalent

Initially we had to find water equivalent for that water have to be boiled till it attained 72 degrees Celsius of temperature and measure it with thermometer at a small interval of time.

Take cold water in a clean washed Thermos flask which record temperature 22 degrees Celsius.When water get heated upto required temperature, mix hot and cold water in thermos flask and stir it till both mix properly reported decrease temperature of hot water and increase in temperature of cold water and temperature become moderate. Note the temperature at repeated interval of time to get water equivalent.

For Heat of Neutralization

Place 20ml of 1N hydrochloric acid solution in Thermas flask. Now record the temperature of the acid solution. Take antoseperate vessel and place 20ml of 1N sodium hydroxide solution in Thermas flask. Calculate Note down the initial temperature of sodium hydroxide taken. Till both the solution attains the same. Now transfer 20ml sodium hydroxide solution into the 20 ml of Ridge Gourd juice the cork immediately which has a thermometer and a stirrer in the. Stir well the solution and note down the temperature after small intervals of. Keep noting down the temperature till the temperature becomes constant Record the highest temperature reached Calculate the heat evolved when the two solutions are mixed by ratio proportion method.

RESULT AND DISCUSSION

Observation

1. ***To calculate the water equivalent of thermos flask***

Volume of cold water=20ml

Temperature of cold water(t1)= 21°C

Volume of hot water = 20 ml

Temperature of hot water (t2)= 72°C

Temperature of mixture(t3)=40°C

2. ***To calculate enthalpy of neutralization of acids present in pomegranate juice using NaOH***

Volume of 1N NaOH=20ml

Temperature of NaOH(t4)=20°C

Volume of Ridge Gourd juice=20ml

Temperature of Ridge Gourd juice(t5)=20°C

Temperature of mixture (t6)=24°C.

CALCULATION

Water equivalent W=100(t2−t3)/(t3−t1)−100

=100(72−40)/(40−21)−100

(100×32/19)−100

W=68.42

Heat of neutralization: (Q)=(100+100+W)(t5−t4)cal

Q=(200+68.42)(24−20)

Q=1074cal

Enthalpy of neutralization: (H)=10×Q/1000cal

H=10×1074/1000=10.74 kcal

The enthalpy of neutralization of amino acid with NaOH is 10.74Kcal.

DISCUSSION

When acid react with base, water and salt is formed and energy is released shows that it is an exothermic reaction.Energy released is known as heat of neutralization which is released due to dissociation of ions and breaking of bonds. Energy released when strong acid react with a strong base is higher than that of weak acid because of complete dissociation of ions. Similarly in this experiment when ridge gourd containing amino acid is mixed with 1N NaOH, a strong base, process of neutralization takes place and heat is released which is known as heat of neutralization.Initially temperature recorded for any NaOH base is 20 degree Celsius and ridge gourd juice is 20 degrees Celsius but when mixed, temperature raise to 24 degrees Celsius.Heat release is lower as compared to is strong acid and strong base mixture which is equal to 57 KJ/mol.

CONCLUSION

The value of heat of neutralization of ridge gourd juice is found to be 10.74 kilo calorie which has standard value of weak acid. The range of heat of neutralization of weak acid is between 9 to 12. The heat of neutralization of ridge gourd which contain weak acid amino acid) is in range of standard value.

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