



Improvement of shelf-life quality of ivy gourd (*Coccinia grandis* L. Voigt) using an exogenous coating of mannitol and sorbitol



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ABSTRACT

Mannitol and sorbitol are considered as suitable osmolytes. In light of this, the two reagents were applied (100 μ M to 400 μ M individually and combinations of 100 μ M + 100 μ M to 400 μ M + 400 μ M) by dipping the ivy gourd fruits in them. The physiological along with physical parameters were assessed with and without (considered to be controlled) dipping in these reagents. The results of the present study reveal that the rate of physiological and physical changes in ivy gourds during storage is influenced by the amount of exogenous mannitol-sorbitol used. In addition to significantly lowering weight, pH, and titratable acidity, the mannitol-sorbitol coating of ivy gourds increases phosphomolybdate activity, total soluble sugar, phenolic content, and pectate lyase activity. It has enzymes that fight free radicals, including peroxidase and catalase, whose activity decreases in stressful situations. In comparison to the other treatments and the untreated ivy gourds, the 300 μ M mannitol treatment offered the highest amount of protection. Hence, ivy gourds' postharvest quality can be effectively extended by mannitol and sorbitol for up to 10 days without significantly affecting their phytochemical and physiological qualities.

1. Introduction

Ivy gourd (*Coccinia grandis* L. Voigt) belongs to family Cucurbitaceae commonly known as tinder, little Gourd, Kundra, kovakkai, kowai fruit, and scarlet Gourd based on the region where it is grown (Wasantwisut & Viriyapanich, 2003). It contains macronutrients such as carbohydrates (3.1%, protein 1.2 g, and total fat (0.2 g) along with dietary fiber (1.6 g) apart from Ca (40 mg), iron (1.4 mg), and potassium (30 mg) as minerals. It also includes the various vitamins B3 (0.07 mg), B2 (0.08 mg), B1 (0.07 mg) along with Vit C (1.4 mg). In addition to being a vegetable, it also has some medical qualities, such as the ability to treat leprosy, asthma, and jaundice. (Medagama, Bandara, Abeysekera, Imbulpitiya & Pushpakumari, 2014). Furthermore, it is also effective against fever, treating tongue sores, etc. Due to its above properties, it needs to be stored for a longer period after harvest. Mostly, it can survive and be in usable condition for a period of 4–5 days after harvest.

Nowadays several postharvest coatings are used to extend the shelf-life of fruits and vegetables. Such types of coatings are polyamines (Patel, Gantait & Panigrahi, 2019b; Trivedi, Mehta & Panigrahi, 2022), starch glucose (Patel & Panigrahi, 2019a), calcium and gallic acid combination (Suthar, Patel, Patel, Panigrahi & Panigrahi, 2021), castor oil (Panigrahi, Patel, Patel, Gheewala & Gantait, 2018), gibberellic acid

(Panigrahi, Gheewala, Patel, Patel & Gantait, 2017), etc. The massive loss of fruits and vegetables following harvest from plants can be addressed with plant-based products that are compatible with fruits and coatings. At the time of stress, particularly water stress that happened after the postharvest, the plant produces the prominent amino acid proline (Liang, Zhang, Natarajan & Becker, 2013) and hence it has one of the exclusive parameters in determining the stress resistance capacity of the postharvest fruits and vegetables. In addition to it, a few enzymatic activities such as peroxidase, catalase, and pectate lyase activities that influence the deterioration of fruits after harvest must be considered while attaining the post-harvest studies (Than et al., 2008; Leite Júnior, C., Kubo, Augusto & Tribst, 2021). Mannitol and sorbitol are examples of plant-based products. These two polyols are identical isomers (Kearsley & Deis, 2006). They are used in food as a sweetener or as sugar-free components. They're also more commonly employed in toothpaste than in the food business (Kearsley & Deis, 2006). Importantly, these polyols have a relatively low glycaemic index, making them suitable for human consumption (Kearsley & Deis, 2006). Furthermore, mannitol and sorbitol are cost-effective in terms of manufacture. Sorbitol is available in both liquid and solid forms, with a variety of liquid themes to match market demand. Mannitol is an immiscible substance and is only

Abbreviations: DMSO, dimethyl sulfoxide; ANOVA, analysis of variance; TSS, total soluble sugar; TA, titratable acidity; SPSS, Statistical Package for Social Sciences.

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Induction of extended shelf-life of cucumber by polyamines

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ABSTRACT

The adequate potential of food and agriculture is a vital key to ensuring a healthy and secure future for the increasing population. The developed crop improvement program has moderately fulfilled the food demand, but with the growing population, the quality of food production needs to be improved to combat global hunger. Further, the process of preservation must be improved to nullify the issue of deterioration of fruits and vegetables, which are considered highly perishable commodities. The introduction of the postharvest technique gives an immense boost to this shelf-life extension of fruit and promotes sustainable agriculture. There is no doubt that multiple preservatives are available to fulfill these requirements. Nevertheless, a few of them may not be suitable due to their negative residual effects; instead, an exogenous coating that can extend the shelf-life period of fruits and delay the deterioration process is preferred. The core point behind the concept is to check the barrier of moisture, respiratory passage, and invasion of solutes through the skin of the fruit. A perfect coating would extend the shelf life without affecting its quality. In recent years, genetic, transcriptomic, and metabolomic research has revealed that different polyamines regulate tolerance to abiotic stress in complex ways. This chapter looks at polyamines as coatings, their biosynthesis, and how polyamines can be applied to cucurbits to confirm the slowing down of the ripening process and maintain the quality of the fruit. These techniques also provide a wealth of ideas to major vendors involved in the storage and transportation of perishable commodities.

Keywords: Exogenous coating, fruits, Polyamines, postharvest, shelf-life

Abbreviations:

Cadaverin: CAD; Putrescine: PUT; Spermidine: SPD; Spermine: SPM

INTRODUCTION

Polyamines are one of the earliest classes of compounds in biochemistry (Galston, 1991). Although, the tetramine spermine (SPM) was first detected in human spermatozoa over 300 years ago (van Leeuwenhoek, 1678), at least two diamine putrescines (PUT and CAD) were first discovered in putrefying corpses more than 100 years ago (Brieger, 1885). Further studies of PUT, SPM, and spermidine (SPD), the most abundant polyamines, were done in the 1920s, which demonstrated that these compounds are nitrogen-containing, and have a low molecular weight (Dudley *et al.*, 1926, 1927). The current view of PUT and SPD is that they are present in every living cell. SPM is also found in bacterial cells (Pegg and Michael, 2009), contradicting earlier assertions that this tetramine does not occur in prokaryotes. According to Illingworth *et al.*, (2003), A portion of the polyamine biosynthesis pathway was assumed to have been acquired by plants from cyanobacteria. Hence, this is a metabolic route originating from ancient plants that are common to all organisms (Minguet *et al.*, 2008). Polyamines seem to be vital for life, based on a variety of studies. As a result, yeast, bacteria, and plants perish when PUT and/or SPD levels are reduced due to chemical or genetic reasons. (Hamasaki Katagiri *et al.*, 1998; Roberts *et al.*, 2001; Imai *et al.*, 2004; Urano *et al.*, 2005). Despite being viable, SPM deficiency causes various levels of malfunction in organisms. Despite not being necessary, SPM can nevertheless have a significant impact on growth and development (Minguet *et al.*, 2008; Yamaguchi *et al.*, 2007; Wang *et al.*, 2004).

Despite their protonation at normal cellular pH, polyamines are thought of as substances with structural properties due to their ability to bind different ionic macromolecules (DNA, RNA, chromatin, proteins) with their tautomeric shape. But it was later discovered that polyamines also function as regulatory molecules in a variety of essential biological functions, in addition to stabilising macromolecular structures (Alcázar *et al.*, 2006; Kusano *et al.*, 2008)). DNA and protein synthesis, cell proliferation and differentiation, cellular death, and gene expression are some of these processes (Seiler and Raul, 2005). An array of physiological processes in plants involving polyamines have been documented, including embryogenesis, fruit development and ripening, floral

A COMPARATIVE STUDY OF DIFFERENT UNIVERSITIES OF GUJARAT STATE PERFORMANCE IN CROSS-COUNTRY

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Introduction

Cross-country running is a sport in which teams and individuals run a race on open-air courses over natural terrain such as dirt or grass. The course typically 4-12 K.M. long, may include surface of grass, earth, pass through woodlands, open country, include hills, flat ground and sometimes gravel road. It is both an individual and a team sport: runners are judge on individual times and teams by a points scoring method. Both men and women of all age compete in cross-country running, which usually takes place during autumn, winter also can include weather condition of rain, sleet, snow or hail, and a wide range of temperatures. Cross-country running is one of the disciplines under the umbrella of athletics and is a natural-terrain version of long distance track and road running.

In India cross-country running competition are organized in different age categories All India Inter Universities level is one of them. This cross-country competition is organized under the banner of Association of Indian Universities (AIU). Competition conduct every year but this COVID-19 pandemic condition it was not organized.

Cross-country team consist of six players in a each team. The Individual player's who finishes on whichever rank , that is considered as the points of that player for Team, best four players points count for team championships. The lowest scoring team is considered as the champions in the competition.

Last year cross-country championship held by AIU in Mangalore University, Mangalore (Karnataka) organized by Alva's Education foundation at Moodbidri. AIU having approximately 875 membership of universities. Only 116 universities participated in championship only 13.25% universities took participate in championship and this percentage ratio is very poor again numbers of universities.

Gujarat state having 1 central, 29 state, 43 state private and 3 deemed universities and totally 77 universities. These is very poor awareness about cross-country competition. Only 11 universities participated in championship percentage ratio is 14.28%. Cross-country is very low budget and equipment less sport. More and more universities take part in cross-country championship.

Limitations of the study

This study was conducted for analyzing men cross-country players' performance taken in all India inter university cross-country championship. Only Gujarat State's university men players' performance were considered as data for study.

Statement of the Problem

A Comparative Study of Performance of Different Universities of Gujarat State in Cross-Country.

Selection of Subjects

The purposive subject selection from each participated universities of Gujarat state was done and best top four men ranking players timing or rank were considered as subjects for this study.

FTIR Spectroscopy of Charge Transfer Complexes of Galvinoxyl

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Abstract- The FTIR spectra of galvinoxyl charge transfer complexes with organic acceptors, such as TCNQ, TCNE, DDQ, chloranil, and iodine, were examined in the current work. This study was carried out between 400 cm⁻¹ and 4000 cm⁻¹, which is the mid-IR range. The existence of hopping conduction in these CT complexes is suggested by a half-power beta density in absorption above 1600 cm⁻¹. Investigating the nature of the transition below 1600 cm⁻¹ reveals a 0.02–0.05 eV narrow bandgap. This small bandgap is connected to the CDW or SDW pinning gap. Significant band tailing or additional shrinking brought on by electron–electron interaction can both bridge the bandgap. The CT complexes exhibit electrical paramagnetic behaviour at room temperature. Galvinoxyl can prevent its transition to a diamagnetic state at low temperatures due to charge transfer.

Keywords- Galvinoxyl with organic acceptors such as TCNQ, TCNE; DDQ; chloranil and iodine, Charge-Transfer Complexes, Donor, Acceptor

1. INTRODUCTION

Solid-state physics and chemistry are particularly intrigued by organic ferromagnetism [1-6]. Instead of the usual anti-ferromagnetic, paramagnetic, or diamagnetic states, the ferro- or ferry-magnetism state is realised in organic systems. Galvinoxyl is a key substance. It is clear from the magnetic susceptibility of galvinoxyl crystals' temperature dependence that the crystal goes through a phase transition at 85 K and turns diamagnetic below that point. This may be connected to the transition at low temperatures from a conductive to an insulating state [7]. A small amount of hydrogalvinoxyl is applied to stop the transformation [8,9]. At a favourable temperature zone, the mixed crystal's reciprocal susceptibility crosses, confirming the existence of the ferromagnetic interaction. The dependence of magnetization on the magnetic field was studied at 2 K. [10-14]. Galvinoxyl radicals with $S = 1/2$ accumulate on average at low temperatures, and their magnetic moments are parallel. Additionally,

a structural analysis has been finished [1]. The amount of exchange contact was calculated using paramagnetic resonance absorption [15-19,24]. We looked at galvinoxyl charge transfer complexes with typical organic acceptors as a result of these discoveries.

2. EXPERIMENTAL

Chloranil, iodine, DDQ (2,3-dichloro-5,6-dyno-p-benzoquinone), TCNQ (7,7,8,8-tetracyano-p-quinoo-methane), and TCNE (tetracyano-p-ethylene) were taken in a molecular ratio of 1:1 with organic acceptors such TCN. The CT complexes were ground into a fine powder form. Create a 1:1 mixture in an agate pestle and mortar. These powders were added to dry anhydrous spectrograde one at a time. KBR powder and rounded palates were produced using a manually operated compressing machine. The dark chamber of the spectrometer was filled with these discs. Spectra in the 400 cm⁻¹ – 4000 cm⁻¹ range were recorded using a Darkroom Elmer Company, USA, GXFTIR single beam single-barometer with a resolution of 0.15 cm⁻¹, a scan range of 15,000 cm⁻¹ – 30 cm⁻¹, a scan time of 20 scan/sec, an OPD velocity of 0.20 cm/sec, and MIRTGS and FIRTGS detectors. A beam splitter of the opt KBR type with a 7800 cm⁻¹ - 370 cm⁻¹ operating range was used. The spectra were recorded in purge mode.

3. RESULTS AND DISCUSSION

We give the molecular structure of galvinoxyl as well as that of common organic acceptors (fig.1). Galvinoxyl molecules cannot sterically approach one another because of the electrical donor function of the butyl groups.

**COMPARATIVE STUDY ON SELECTED PHYSICAL FITNESS ABILITY VARIABLES AMONG
DIFFERENT TEAM GAMES PLAYERS SCHOOL LEVELS****Mr. Gamit Sanjay**
Guide**Dr. V. J. Chauhan****Abstract**

Purpose of the study was to compare the physical fitness variables of team game players' i.e. soccer, cricket, and field hockey intercollegiate 45 male players. The age of the subjects were ranging 12-17 years and the selected three groups (soccer, cricket and field hockey) contain 15 subjects from in each group. Collected data on the Physical Fitness variables i.e. muscular strength, muscular endurance, agility, and speed was analyses through descriptive statistics, one-way ANOVAs, and post-hoc (LSD) test at the level of confidence 0.05. No significant differences were founded in physical fitness variable i.e. muscular endurance, speed, and agility whereas significant differences were founded only in muscular strength between soccer, cricket, and field hockey male intercollegiate players. On the basis of the results and findings it was concluded that cricket players have better muscular strength in comparison to soccer and field hockey male intercollegiate players.

Keywords: Fine motor skills, fitness orgasm, physical condition, sports performance

Introduction

There are numerous factors which are responsible for the performance of sportsmen in team games. Likewise, human body composition and physical fitness factors that plays a governing role in team game sports performance at elite as well as professional level. Further, the success of team sports also involves physiological and physical well-being factors which are prerequisite for excellence in sports. In realism, the combination of physical fitness aspects related to health and skills are influencing sports and team games aspirants. Unlike, most of the team game sports performance demands are depending upon a greater amount of collective and co-operative fitness orgasm in addition to accurate, correct and fine motor skills, tactical qualities, playing style, seasonal time, and individual and team morale respectively. But, "The complex nature of physical fitness includes muscular strength, muscular endurance, cardio respiratory endurance and the most important of them is the cardio respiratory endurance" also described the difference in endurance in different team games (Football, Volleyball, and Basketball). Were investigated and compared the physical fitness components and sports performance variables among different team games respectively.

And, the results and findings of the above mentioned studies were also stressed on the related evidences that every team game required different combination of dominate physical fitness variables as per the pace and play of the game in contrast to, this oppinionnaire and understanding that every team game has similar kind of physical fitness combinations. Singh and also deter minded that the players of different team games i.e., soccer and volleyball were having similar cardiovascular endurance status.

Furthermore, Kumar *et al.*, compared the physical fitness variables between university and intercollegiate basketball players and identified that university basketball players have better physical fitness than intercollegiate players which means different level of game demands different level of physical fitness condition. founded better upper body strength and endurance in basketball players and sprinters were having better lower body strength respectively Reported the differences between the field hockey and cricket school level players in speed, agility, leg explosive power and cardio respiratory endurance.

In fact, the team games requires distinctive skills, tactics, and movement patterns, they may all have similar physiological demands such as high aerobic power, high agility, muscular strength and increased anaerobic capacity. Moreover, the certain physical fitness components such as motor skills, speed, body flexibility, endurance, body strength, explosive power, agility, and leg strength can provide effective performance in sports such as football, cricket, and field hockey. For this reason, the main purpose of

A Comparative study on BMI of Inter University Rural and Urban Player

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Researcher

Guide: **Dr. Virendar Chauhan**

Abstract

The purpose of this study was to compare rural and urban players BMI this study conducted in Veer Narmad Dakshin University this study was delimit for boys and age was 18-25, player were selected from kho- kho game of urban and rural player total players was (24) 12 of urban and 12 of rural players for comparative study their BMI was taken from research it was found that rural player BMI was better than urban players

Key word: Rural, Urban, BMI

Introduction

The physical fitness of youth is influenced by a variety of factors, including age and sex, body size and composition, biological maturity status, level of habitual physical activity, and increments in the prevalence of overweight and obesity in youth worldwide, there is interest in the relationship between fatness and physical fitness. The body mass index (BMI) is a measure that uses your height and weight to work out if your weight is healthy. For most adults, an ideal BMI is in the 18.5 to 24.9 range. For children and young people aged 2 to 18, the BMI calculation takes into account age and gender as well as height and weight. The BMI calculation divides an adult's weight in kilograms by their height in metres squared.

Method

For this study kho kho players BMI was taken the players was from rural team and urban team BMI was calculated with $\text{weight} / \text{height}^2$. Total 24 players was taken. For statistical analysis mean was taken it has shown in table 1 and graph 1

Results and conclusion

Test name	Rural player	Urban player	Mean difference	T test
BMI	20.07	21.82	1.75	1.77

Significant level (0.05) 2.06

From this table it shows that Rural players BMI total was 240.94 and urban players BMI was 261.92 and mean was 20.07 of Rural players and Urban players was 21.82 so both mean difference was 1.75 so from research it seems that Rural players BMI was better than Urban players for statistically analysis t test was taken and significant level was not approved in this research

A STUDY ON THE ELECTRONIC CHANGES IN CHARGE-TRANSFER COMPLEX

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ABSTRACT

With the usual lapse of time, the electronic absorption spectra of various charge transfer (CT) connections have exhibit several types of disappearance and appearance of correlation of spectral bands. Proper research of the structural formulae of the various types of species implicated in connections and exchanges comprising their intermediates and outcomes that have responsible to give suitable explanations of the recognized time-dependency. With the help of Spectrophotometric and conductometric titration methods introduced by Job, the stoichiometry can be easily determined. The values of conductivity of the CT- complex are found to have the range of semiconductors pointing out the dissociation of CTC to form ionic species. CTC's electronic change is mainly responsible for the formation of protonated inner sigma complex. The inner sigma complex and the CTC get support from the DFT studies.

Keywords: 1-Benzoylpiperazine; P-chloranil; Donor; Acceptor; DFT; Charge transfer complex

Study on Synthesis and Biologically Important of 2-Mercaptobenthiazole (MBT)-clubbed Chalcone Derivatives

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Abstract

In this present work base catalyzed method used for formation of chalcone of (E)-4-(3-(4-hydroxyphenyl)acryloyl)-5-methyl-2(*p*-tolyl)-1H-pyrazol-3(2H)-one (II) reacted with derivatives of S-benzo[d]thiol-2-yl-2-chloroethanethioate (I_{a-f}) resulted in formation of corresponding derivatives of (E)-S-benzo[d]thiazol-2-yl 2-(4-(3-(5-methyl-3oxo-2(*p*-tolyl)-2,3-dihydro-1H-pyrazol-4-yl)-3-oxoprop-1-en-1-yl)phenoxy)etanethioate(III_{a-f}) was confirmed by spectral characterization such as IR, ¹H NMR, LC-MS and elemental analysis. The compounds were screened for their antimicrobial properties against a broad panel Gram-positive and Gram-negative bacteria as well as fungi. Compound 3c and 3e shows good activity. All the synthesized compounds were



Synthesis and biological evaluation of azetidinone derivatives with pyrazolone moiety

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A Schiff base has been prepared by the reaction of 4-acetyl-5-methyl-2-(4-methylphenyl)-2,4-dihydro-3H-pyrazole-3-one with different substituted amines. Treatment of this Schiff base with chloroacetyl chloride affords the corresponding azetidinone in good yield. All the new compounds have been characterized by IR, ¹H NMR, GC-MS and elemental analysis. The antibacterial activity of these compounds has been determined with the reference of standard drug.

Keywords: 2-Azetidinone, pyrazolone, Schiff base, antimicrobial activity

The synthesis of heterocyclic compound has always drawn the attention of chemist over the years mainly. Because of their important biological activities¹. Pyrazolones is a five-member heterocyclic compound containing one ketonic group and two nitrogen atoms adjacent to each other. Pyrazolone derivatives play an important role in heterocyclic compound history and possess considerable biological activities, thus making it an important pharmacophore for carrying out further drug research². One such heterocyclic, 2-azetidinone, a very well-known compound for the medicinal chemistry, since it forms a part of antibiotic molecules³. They are carbonyl derivatives of azetidinone containing carbonyl group at position- 2. These are known as 2-azetidinone⁴. The 2- azetidinone ring system, a common structural features of a number of wide spectrum β -lactam antibiotics, including penicilins, cephalosporin, carbapenems, nocardiacins and monobactams, which have been widely use as chemotherapeutic agent to treat bacterial infections and microbial diseases⁵. The utility of azetidinone as synthon for various biological active compounds as well their recognitions as antibacterial⁶, anticonvulsant⁷, antimicrobial⁸, antitubercular⁹, anti-inflammatory¹⁰, anthelmintic¹¹, anesthetic¹², antioxidant¹³. They also function as enzyme inhibitors¹⁴ and are effective on the CNS¹⁵. Cycloaddition of monochloroacetylchloride with imines (Schiff base) result in formation of 2- azetidinone(β -lactam). The reaction involves direct acylation of Schiff base with monochloroacetylchloride. The reaction is carried out with base as triethylamine gives β - lactam.

Result and Discussion

Chemistry

Azetidinone derivatives III1-5 were prepared using the method summarized in Scheme I. First, 3-methyl-1-(4-methylphenyl)-2-pyrazolone acylation gives 4-acetyl-5-methyl-2-(4-methylphenyl)-2,4-dihydro-3H-pyrazole-3-one derivatives I(1-5). Compounds I(1-5) on reaction with substituted amines afforded Schiff base derivatives II(1-5). Finally the Schiff bases upon reaction with chloroacetyl chloride in the presence of triethylamine afforded azetidinone derivatives III(1-5).

The structure of compounds was assigned on the basis of spectral data. In the IR spectra of azetidinone derivatives the carbonyl group of the β -lactam ring appeared as a characteristic absorption band in the IR range 1660-1675 cm^{-1} . The IR absorption bands and ¹H NMR signal characteristic of azomethine group disappeared from the spectra of azetidinone derivatives which conforms that the cyclization reaction with chloroacetyl chloride took place. The ¹H NMR spectra of III(1-5) showed signals, which are characteristic for CH-Cl that appears in the range of 5.2-5.9. Synthetic route is given as below.

Experimental Section

Melting points were recorded in open capillary tube and are uncorrected. The IR spectra were recorded on a Perkin-Elmer 37 spectrophotometer and ¹H NMR spectra were recorded in DMSO-*d*₆ with TMS as internal standard on Bruker AM 400

Synthesis and Structural Characterization of GeSePb_{0.1} Single Crystals by Direct Vapour Transport Method

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ABSTRACT

The need for advanced materials has stimulated large areas of research especially in the field of metal chalcogenides and their intercalation compounds. The present investigation reports on the synthesis of the GeSePb_x (x =0.1) compound grown using the Direct Vapour Transport (DVT) Technique. To confirm the composition of the grown crystals, Energy Dispersive Analysis of X-ray (EDAX) is performed. The lattice Parameter, Unit Cell Volume, and Density are obtained from X-ray Diffraction. The phase composition and optical properties of as-grown crystals are examined by Transmission Electron Microscope (TEM).

Keywords: Crystal growth, direct vapour transport (DVT) technique, structural characterizations

INTRODUCTION

The metal chalcogenides have revolutionized the world of optoelectronics owing to their low phonon energy (270-470 cm⁻¹), higher linear refractive index (2-4), Broad IR optical window (1-20 μm), and photoinduced anisotropy [1]. The metal chalcogenides have the ability of multiple reversible transitions between the amorphous crystalline phase. Among the various chalcogenide systems, germanium modified glasses can be used in IR sensors in the biomedical processes and gas detection. Optomechanical devices based on photoinduced Optomechanical effects and phase change optical memories. Z-scan measurements of Ge-As-Se revealed high optical nonlinearity of 24×10⁻¹⁸ m²/W, high refractive index (~ 2.5), and suitable optical transmissions at 1540 nm which make it applicable as a core material in optical fibers for telecommunication applications [2-5]. Transition Metal Dichalcogenides (TMDCs) offers properties such as flexibility in synthesis,

mobility, environmental stability, carrier concentration, structural, vibrational and highly crystalline nature, and hence become the most fascinating material [6-14]

EXPERIMENTAL

The single crystals of GeSePb_{0.1} are available in nature, so they have to be synthesized in the laboratory. These compounds are having a layered structure, and they are insoluble in water, also they decomposed before reaching their melting point. Moreover, they sublime at a higher temperature; hence, the growth of single crystals of such compounds from melt and the aqueous solution is not possible. The vapour transport method offers the advantage of growth at a lower temperature below their melting point [15] and found to be most suitable for these types of compounds. Therefore, vapour transport method is used for the growth of single crystals of GeSePb_{0.1} (DVT). In this technique, a stoichiometric mixture of

Synthesis and Characterizations of $\text{GeS}_{0.5}\text{Se}_{0.5}$ (I_2) Single Crystals

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Abstract

Material processing of layered structure remains a widely investigated subject in recent time due to their anisotropic properties. The large volume of work carried out in this field is of importance not only in basic science but also in industrial as well as energy applications. In this paper authors report growth of $\text{GeS}_{0.5}\text{Se}_{0.5}$ (I_2) single crystals using Chemical Vapour Transport (CVT) technique with iodine as a transporting agent. Photograph of Energy Dispersive Analysis of X-ray (EDAX) showed that $\text{GeS}_{0.5}\text{Se}_{0.5}$ (I_2) single crystals were nearly in stoichiometry. The structural characterization of grown crystal was done using X-ray Diffraction (XRD) technique, which reveals the orthorhombic structure of grown crystals and based on these data different lattice parameters were calculated. The single crystallinity was verified through Transmission Electron Microscopy (TEM). The Hall Effect measurements were made on cleavage surface of the single crystal along the layers, i.e., perpendicular to the direction of c-axis. Various parameters like Hall Coefficient, Carrier Concentration, Type and Mobility were measured with varying magnetic field. P-type nature of the grown crystal was confirmed from the obtained value of Hall Coefficient.

Keywords: Crystal Growth, EDAX, XRD, TEM, Hall Effect measurements

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INTRODUCTION

The science and technology enjoy a degree of sophistication today largely due to the availability of high-quality materials. Semiconductors are essential for all the electronic devices ranges from wristwatches to satellite and in many industrial applications [1]. Currently the interest in materials science of the layered chalcogenides occupy a prominent place because of the remarkable range of properties they exhibit. In addition to these chalcogenides offer interesting electronic as well as optical properties [2, 3] which have also been intensively investigated. The layer-like semiconductors have generated enormous interest as a group of anisotropic materials with strong bending within the layers and weak van der Waals bonds between layers [2], these materials have been used for many years as solid-state lubricants [4], photovoltaic/photocatalytic, solar energy converters [5], Schottky [6] and liquid junction solar cells [7, 8]. These compounds have been investigated in crystalline form grown using

various techniques. The vapour transport technique has been proved as a very good technique to grow good quality single crystals though it has its own limitations and difficulties. DVT transport technique is the preferred technique to avoid the contamination due to transporting agent [9, 10]. In this paper, authors report growth of $\text{GeS}_{0.5}\text{Se}_{0.5}$ (I_2) crystals by vapour transport technique.

EXPERIMENTAL WORK

Growth

Prior to the crystal growth, the powdered components of $\text{GeS}_{0.5}\text{Se}_{0.5}$ were prepared from the elements (Ge: 99.99%, S: 99.99%) and Se: 99.99%) by reaction at 750 K for 2 days in evacuated quartz ampoules (25 mm OD, 22 mm ID, 22 cm length). The mixture was then slowly heated to a required temperature. The slow heating was necessary to avoid any explosion due to the strong exothermic reaction between the elements. A total charge of nearly 10 g plus 4 mg/cc of the transporting agent iodine (I_2) sealed in a quartz tube were