INTERNATIONAL JOINT CONFERENCE ON SCIENCE AND TECHNOLOGY

SCIENCE, TECHNOLOGY, INNOVATION, AND CULTURE FOR SUSTAINABLE DEVELOPMENT: CHALLENGE FOR GREEN INDUSTRY

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IJCST 2017 PROCEEDING

Main Theme:

Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry

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Theme:
"Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry"

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Preface

Ladies and Gentlemen,

It is my great pleasure to welcome you all to The 2nd International Joint Conference on Science and technology –IJCST 2017 in Nusa Dua Bali-Indonesia 27-28 September 2017. This conference is multidisciplinary including engineering and social science and hope can dedicate a positive contribution to science and technology development. Hosted by Bali State Polytechnic (PNB) and other established university partner including UPNV Jatim, FMIPA-UNISA, FISH-UNESA, and UTM, this conference are attended by more than four hundreds participants who present their best research results.

Papers have been reviewed by peer reviewers and already presented orally in the conference. Some selected paper are already submitted to be published in the **Journal of Physics: Conference Series** (http://jpcs.iop.org) and The International Journal of GEOMATE and automaticaly others are published in The IJCST 2017 proceeding. With high confidence, depend on the paper topic and quality will can reach aim and topic of the conference "**As an international platform for scholars, researchers, practitioners, and government to discuss interdisciplinary research and practices that focuses in the theme of "Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry**".

We would like to extend our warm and sincere thanks to authors for great contribution in this conference, and thank God so this proceeding can be completed and finished as planning. Hopefully all participants and authors can extend to build a networking each other in order to improve the research quality in future.

Sincerely yours,

IJCST 2017 Committee

Remark from Conference Chair

The honourable Minister of Tourism Republic of Indonesia
Distinguish guest and participants of IJCST 2017
Welcome to Bali – a wonderful Indonesia

The past few years has witnessed the idea of "Green Economy" flowing out from its realm of environmental economics. It is now omnipresent in mainstream policy discourse, our popular culture, industries, and development of disruptive technologies. It has successfully won the headspace and commitments of the world leaders as reflected in the Paris Agreement, the United Nations Sustainable Development Goals, G20 communiques.

The time to debate about whether we should transition to a green economy has now ended. It has been agreed upon to be the only way forward. However; shifting from the traditional 20th century model to a new green society requires massive investment and transformative disruptions. Delivering this ambitious global project requires strong public-private-partnerships and cross-sector collaborations. The 2nd International Joint Conference on Science and Technology (IJCST) 2017 aims to advance both by providing a multi-stakeholder platform for concerted action, research, and sharing of best practices under the theme "Science, Technology, Innovation, and Culture for sustainable development: Challenge for Green Industry"

I would like to welcome all of you to the IJCST 2017 and express my gratitude for the expertise you bring to our gathering. You are truly our greatest asset today and I encourage you to stay engaged, keep us proactive, and help the world shape the future of green economy.

I wish you a great conference and wonderful time in Bali.

Sincerely yours,
Conference chair
Dr. Ir. Lilik Sudiajeng, M.Erg

Welcoming Addressed by Director of Bali State Polytechnic

You're Excellency Minister of Tourism Republic of Indonesia
Distinguish guest and participants of IJCST 2017

Good morning

It is my pleasure welcoming you in Bali-the wonderful Indonesia, to attend the International Joint Conference on Science and Technology (IJCST) 2017.

This is the 2nd IJCST, which is held by Bali State Polytechnic, in collaboration with University of Pembangunan Nasional Veteran-East Java; University of Trunojoyo Madura-East Java; State University of Surabaya-East Java; and National Cheng Kung University Taiwan.

The conference is to aim an international platform for scholars, researchers, practitioners, and government to discuss interdisciplinary research and practices under the theme of "Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry". This theme is raised as a manifestation of the academic community's sensitivity towards global environmental issues that are now shifting from the issue of global warming to green economics.

It is an honor for me to convey that over 350 participants attended this conference from 14 countries. I give highly appreciation for your attendance. Your presence at this conference is very important to help the world in formulating green industry that leads to green economy.

Finally, wishing you a great conference and enjoy Bali, the wonderful Indonesia.

Bali State Polytechnic
Director,

Ir. Made Mudhina, MT.

Speech by Minister of Tourism

OPENING SPEECH

MINISTER OF TOURISM, REPUBLIC OF INDONESIA

International Joint Conference on Science and Technology (IJCST),
Nusa Dua Bali, 27 September, 2017

First of all I would like to extend my appreciation and gratitude to the committee of International Joint Conference on Science and Technology (IJCST) for exposing the theme of the conference on Science, Technology, Innovation, and Culture for Sustainable Development: Challenge for Green Industry. The theme is strongly intersected with global tourism development, since tourism is an integrated economic development involving high technology, innovation, culture and natural sphere.

The theme has clearly revealed that sustainable tourism, as part of sustainable development, is a joint effort among stakeholders. Multi-disciplinary research has to be constantly and mutually done to create green tourism economy, where tourism can be a catalyst of natural and cultural preservation, at the same time improving people's quality of life. Tourism development requires advanced technology, in transportation, information, and communication sector to ease tourist movement in accessing main attractions. Culture and nature are the main attractions for tourism, the question is how are they utilised to generate foreign exchange earnings but at the same time managing its sustainability.

It is imperatively expected that this scientific gathering will bring about new ideas and solutions as well as mutual commitment among practitioners and academicians to make tourism more sustainable and responsible, as mandated by UNWTO. Sustainable development is dealing with present and future generations welfare. Sustainable tourism is actually defined by the resonance of its sustainable development, benefiting present and future tourists and communities and viable within indefinite time, maximizing its economic gains.

Indonesia's tourism is mainly based on culture and nature as its main portfolio products. Resources related with the portfolio products has to be carefully and responsibly managed to ensure its sustainability. Research in new technological inventions and innovations have to be continuously developed to promote better tourism for our present and future generations. We cannot avoid using technology especially for the connectivity and digital marketing of our tourism, but we have to manage it to maximize its economic, cultural and natural benefit. I do hope that this conference will provide a great opportunity for the participants to share and understand both local and global issues of tourism development.

Wishing you all a very fruitful and rewarding conference.

Greetings from **Wonderful Indonesia**

Jakarta 18 September, 2017

Dr. Ir. Arief Yahya, M. Sc.
Minister of Tourism, Republic of Indonesia

Speech by Rector of Trunojoyo University Madura

Guest of Honour, Dr. Ir. Arief Yahya, M.Sc.
Minister for Tourism, Republic of Indonesia.
Mayor of Denpasar City,
Ida Bagus Rai Dharmaijaya Mantra, SE.,M.Si.
Distinguished speakers,
Researchers and Colleagues,
Assalamu'alaikum Warrohmatullahi Wabarokaatuh.

Praise goes to the most merciful God Allah SWT for the blessings of life and knowledge for us to gather on this meaningful occasion.

To start with we would like to warmly welcome the eminent speakers and delegates who have come from all over the world. We are indeed honoured to have you here with us, making this conference a truly international one.

Ladies and gentlemen,

The university of Trunojoyo Madura is located on Madura island as a part of East Java province area, and currently, it is on 16 years old. This university has committed to escalating its educational process and research activity. It is because those processes play a pivotal role to aim the vision of University of Trunojoyo Madura for a period 2014 – 2018. One of main strategies to achieve the University's vision is by implementing a cluster approach in order to increase the University of Trunojoyo Madura's competitive advantage. This approach is carried out by strengthening our research based on six potential sectors. These sectors are (1) salt and tobacco sectors, (2) food commodities sector (corn, cassava, cane, cattle, and sea commodities), (3) energy sector (oil and gas, renewable energy), (4) educational sector (formal and informal education), (5) social sector (worker and women studies), and (6) tourism and creative economic. All of these sectors are regarded to Madura resources.

Ladies and gentlemen

We do realise that the process of strengthening our research cannot be accomplished by ourself. It would be hard for the University of Trunojoyo Madura if only relaying it on our internal resources. A mutualism collaboration is needed, a collaboration which involves other external parties including universities, governments, businesses, and any other parties. Therefore, on this occasion, Faculty of Engineering, University of Trunojoyo Madura runs an International Conference for the second time called ICOSE (International Conference on Science and Engineering). The ICOSE is held in collaborating with several big universities namely Bali State Polytechnic, University of Pembangunan National Veteran of Surabaya, State University of Surabaya on one event named IJCST (International Joint Conference on Science and Technology) 2017. We hope that this conference will generate an advantageous knowledge sharing about previous research results and bright outlooks. Henceforward, University of Trunojoyo Madura wishes could achieve its vision with a better result.

In closing, we encourage delegates to participate actively in interesting discussions over the seminar periods. I wish everyone has a successful and fruitful conference.

Thank you very much

Wassalamu'alaikum Warrahmatullohi Wabarokaatuh

Speech by Rector of State University of Surabaya

It is with great pleasure that I extend my warmest welcome and best wished to all keynote speakers, presenters, and participants of the 2017 International Joint Conference on Science and Technology (IJCST), "Science, Technology, Innovation, and Culture for Sustainable Development: Challenge on Green Industry."

IJCST has worked with partners from higher education institutions and polytechnic from Indonesia and People's Republic of China, namely UPN Jawa Timur, Universitas Negeri Surabaya, Universitas Trunojoyo, Politeknik Negeri Bali, Politeknik Negeri Jember, and National Cheng Kung University. Each institution contributes largely to the success of the 2017 IJCST by gathering academics and professionals across the country and overseas with aims at sharing recent investigations of the theme and hoping they would fruitful to stakeholders in resolving challenges on green industry.

With regards to challenges that Indonesia and countries at the global level encounter particularly demographic plus in 2020 and a surge of primary needs including clean environment as well as increased international mobility of people from various cultures, the 2017 IJCST plays a crucial role in offering innovations and resolutions of those challenges. By so doing, proposals and recommendations withdrawn from the present conference will then serve as the basis for relevant stakeholders in policymaking.

I have always believed that IJCST has been an insightful platform for intellectuals and practitioners to continuously create breakthroughs in support of achieving sustainable development. My best wishes for a fruitful and productive conference.

With regards,

Prof. Dr. Warsono, M.S.
Rektor

Speech by Rector of University of Pembangunan Nasional Surabaya

Assalamualaikum Wr. Wb. , Good Morning
Honorable Guests:
Ministry of Tourism of Republic of Indonesia, “Ir. Arief Yahya, M.Sc”
Governor of Bali, “Made Mangku Pastika”
Directorate General of Research and Development, “Dr. Muhamad Dimyati, M.Sc.”
Director of Bali State Polytechnic, “Ir. Made Mudhina, M.T.”
Honorable Keynote Speakers :
Mayor of Denpasar City, “Ida Bagus Rai Dharmawijaya Mantra, SE, M.Si”
Head of Badung Regency, “Nyoman Giri Prasta, S.Sos”
Attache of Educational Affairs – Embassy of France in Indonesia, “Prof. Dr. Emilienne Baneth Nouailhetas”
Prof. Dr. Zakaria Hossain, Prof. Moonyong Lee, Prof. Jyh-Ming Ting, Dr. Yusri Yusof, Reviewers, and Last but not least beloved particpants,
Thank God for granting us with blessings, that we could gather here today in this very special moment, “International Joint Conference on Science and Technology 2017” organized by UPN “Veteran” Jawa Timur, Bali State Polytechnic, National Cheng Kung University, University of Trunojoyo, Surabaya State University, and Jember State Polytechnic.
Ladies and Gentlemen,
Environmental problems has been a very significat issue for many parties, especially for business actors. Either help the environment and hurt your business, or irreparably harm your business while protecting the earth. With such problems, it might be wise for us to focus on the promotion of several environmental-friendly steps, some to mention are low-carbon paths to industrial development; efficient use of non-energy raw materials; adoption of relevant products and technologies to meet environmental standards; adoption of environmental and related management systems with a view to entry into global value chains; and creation of businesses that can offer services in these areas.
The theme chosen is concerning with the current problem, Green Industry which is related to the increasingly polluted environment as well as the increasingly expensive energy problems that needs finding ways of savings. It is gratifying to note that the agenda of the seminar covering a wide range of very interesting items relating to the theme.
We believe this seminar is a great opportunity for all delegates to discuss the existing problems concerning science, technology, innovation, and culture for sustainable development in answering challengess for green industry.
Distinguished guests,
I wish this moment not only could enrich a broader knowledge, but also make new friends, and build net working in crearting better future.
At last but not least, I would like to express my greatest appreciation to everyone who has supported and brought this seminar into success, and we truly apologize for any inconveniences may arise during the seminar.
Thank you
Wassalamualaikum Wr. Wb.

Denpasar, September 27, 2017
Rector of UPN “Veteran” Jawa Timur
Prof. Dr. Ir. H. Teguh Soedarto, MP

Sponsor or funding acknowledgements

We are delighted to acknowledge the financial support received from Bali state Polytechnic-Ministry of Research , Technology and Higher Education- Indonesian Government and also the excellent support received from Mayor of Denpasar City, Governoor of Bali Province, Rector of Trunojoyo University Madura, Rector of State University of Surabaya, Rector of University of Pembangunan Nasional Surabaya.

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Determination of chromium content in various foodstuffs

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Abstract. Research has been conducted to identify the content of chromium in foodstuffs, including broccoli, celery, snake grass, green mustard greens, tomatoes, carrots, beans, green beans, cauliflower, chicory, cassava, potatoes, black rice, white rice, brown rice, black sticky rice, yeast (bakery yeast) and yeast extract commercial. The determination of chromium was carried out using voltammetry method, whichthe results were processed using OriginProprogram. The data were then analyzeddescriptively. The results showed that the foodstuffs containing the highest $Cr^{3+}$is cauliflower that is 280 x 10^{-4}%, but the Cr^{6+} content is83 x 10^{-4}%.The foodstuffs containing Cr^{6+} in small quantities are cassava, nuts and commercial yeast, which is about 8 x 10^{-4}% to 9 x 10^{-4}%, but Cr^{3+}content is also not very high that is about 18 x 10^{-4}% to 21 x 10^{-4}%.

Keywords: Chromium content, Foodstuffs, Chromium in foodstuffs, chromium determination

1. INTRODUCTION

Chromium is one of the seven most abundant elements in the Earth's crust and at low concentrations is an essential element for living organisms naturally. Chromium is present in various forms of compounds. In addition to being Cr metal, the chromium is found as Cr^{2+}, Cr^{3+} (trivalent chromium), and Cr^{6+} or chromium hexavalent. Cr^{3+} is known to be non-toxic, while Cr^{6+} is toxic to the human body. Cr chemicals are persistent, bio-accumulative, toxic and not readily degradable in the environment, thus accumulating in the human body through the food chain. Cr from for example the soil environment is entering the food chain through the plant.According to the World Health Organization, Cr^{6+} concentrations in soil should not be more than 0.05 mg/L or 50 ppb [1]. Cr^{6+} compounds also have genotoxic, mutagenic, and carcinogenic properties [2]. The toxicity brought by this metal can harm vital organs such as liver, kidneys, cause lung cancer, acute poisoning, chronic, irritation to the respiratory system, and irritation to the human skin [3].

Various natural ingredients including foodstuffs are known to contain chromium, both Cr^{3+} and Cr^{6+} ions. Several studies have revealed that consumption of chromium can decrease type 2 diabetes mellitus (DM). Chromium is an essential mineral that the body needs for carbohydrate and fat metabolism [4]. Diabetes mellitus type 2 (T2DM) is the most common form of diabetes found worldwide [5] [6] [7]. This is characterized by abnormalities in pancreatic insulin secretion or actions that cause hyperglycemia due to impaired metabolism of carbohydrates, fats and lipids [5][7]. T2DM prevalence worldwide is increasing and more than 366 million people are expected to be affected by 2030[5][7]. T2DM is continuing to be a public health concern, and many people are using alternative medicine using chromium.Chromium is a common supplement used by many T2DM patients for the purpose of improving glucose regulation and in 2002 sales of chromium supplements were estimated at $85 million [8].

According to the National Institute of Health: Dietary Supplement Office, adequate intake of Cr for men and women is 35 and 25 µg/day, receptively [5][9][10]. Chromium chloride is a natural

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trivalent chromium variety found in common foodstuffs sources such as: whole grains, broccoli, mushrooms and green beans. In contrast, Cr picolinateis the synthetic family of Cr chloride. Additional forms of Cr supplements can also come from Cr's yeast and brewer's yeast.Chromium is an important micronutrient associated with the regulation of many processes in the human body including glucose homeostasis.Chromium helps regulate glucose homeostasis by activating insulin receptors through chromodulin oligopeptide thus increasing insulin signal transduction and sensitivity. Cr deficiency can lead to glucose intolerance, high circulating insulin, hyperglycemia at the time of fasting, and even disruption of growth [5][11].

Chromium can be obtained from foodstuffs and is available in very small quantities (1-2 micrograms or less). Chromium in the foodstuffs has a form of chromium (III) (indicating the amount of oxidation). Trivalent chromium or chromium (III) or Cr^{3+} is the most stable chromium and most secure, including one of the least toxic. Cr^{3+} is relatively harmless and has a role in the body's metabolism, while Cr^{6+} has a potential of 100-1000 times more toxic than Cr^{3+} because it has a high oxidation potential.

The following is a list of foods rich in chromium: broccoli (18.55 mcg/1 cup), barley (8.16 mcg/0.33 cup), oats (5.38 mcg/0.25 cup), beans (2.04 mcg/1 cup), tomatoes (1.26 mcg/1 cup).Chromium has proven its involvement in the mechanism of treatment of type 2 diabetes in several ways, including by increasing glucose tolerance. Chromium supplements increase glucose tolerance in humans with type 2 of diabetes [12]. Cr supplementation with brewery yeast may provide a marginal benefit in lowering blood glucose levels in patients with T2DM compared with placebo but no effect on glycated hemoglobin [5].

It is generally accepted that chromium is an essential element for humans. Chromium deficiency has been described in both humans and animals, but a clear quantitative definition of the daily requirement of chromium in human nutrition has not been arrived at estimates that the daily minimum population mean intake likely to meet normal requirements for chromium mightbeapproximately33µg/person [1]. Results of panels related to the Food Supplement and Nutrition Source, Cr^{3+} added to food and food aimed at the general population (including dietary supplements), concluded that after oral administration, trivalent chromium is poorly absorbed. The result of in vitro bacterial mutagenic test consistently is negative. The panel concluded that in very large quantities, certain trivalent chromium compounds have been shown to be cytotoxic and cause chromosomal damage. The panel also evaluated long-term toxicity and carcinogenicity data for Cr^{3+}. Based on the facts, it is known: 1) a maximum intake level of up to 250 µg/day for additional intake, 2) that in vitro, at high levels of concentration, Cr^{3+} can cause DNA damage, 3) that DNA damage is not reflected in the in vivo genotoxicity test, 4) that Cr^{3+} is not carcinogenic, 5) that it is safe for a daily intake of 250 µg/day, equivalent to 4.1 µg/kg body weight/day for people 60 kg [13]. Although chromium is an essential trace element for humans because it helps us to use glucose. However, it is poisonous in excess.

Daily chromium intake according to US dietary guidelines is 50-200 mg for adults, 30-35 mg for adult males and 20-25 mg for adult women [14][1].. About 2% of Cr^{3+} or trivalent chromium can be absorbed and the rest is excreted in the stool.Amino acids, vitamin C and niacin can increase the absorption of chromium by channels of the intestine. These minerals further accumulate in the liver, bone, and spleen. Trivalent chromium is found in a variety of foodstuffs, including wheat products, processed meats, cereals, coffee, beans, green beans, broccoli, spices, and some brands of wine and beer. Most fruits and vegetables and dairy products contain only low amounts.

2. METHODOLOGY

2.1 Preparation of materials

Foodstuffs identified about their chromium content are broccoli, celery, snake grass, green mustard, lettuce, tomatoes, carrots, beans, green beans, cauliflower, chicory, cassava, and potatoes, black sticky rice, white rice, brown rice, black rice, yeast (bakery yeast) and yeast commercial extract. The foodstuffs cut into small pieces, then weighed each 5 grams. The next step of each

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foodstuff is heated in a furnace at a temperature of 700ºC for 7 hours to obtain ash. The obtained ash is dissolved in 1 ml of the concentrated HNO_3 and 1 ml of the concentrated HCl. Each solution is ready to determine its chromium content.

2.2 Determination of chromium content

Determination of chromium content is done by using voltammetry method. Instrument used is Voltammeter.The chromium to be determined is Cr^{3+} and Cr^{6+}. The first step taken on the determination of this chromium content is to make a standard solution. The standard solution used was prepared by dissolving $K_2Cr_2O_7$ and $CrCl_3.6H_2O$ in variations of 5, 10, 20, 40 and 80 ppm. Measurements were made using Silica Carbon Electrode with scan rate of 50mV/sec [15]. Measurement of standard solution using voltammeter produces voltammogram, which then processed using Origin-Pro program and made standard curve between concentration versus current, so obtained linear regression equation y = a + bx. Then measured each sample solution or foodstuff, the result is incorporated into the equation.

3. RESULT AND DISCUSSION

Figures-1 and -2 show the standard curves of Cr^{3+} and Cr^{6+} in variations of concentrations of 5, 10, 20, 40, and 80 ppm. The regression equation obtained from the standard measurement of Cr^{3+} is Y = 3.370798x + 0.004378 and the regression equation obtained from the standard measurement of Cr^{6+} is Y = 3.139306x + 0.008648.

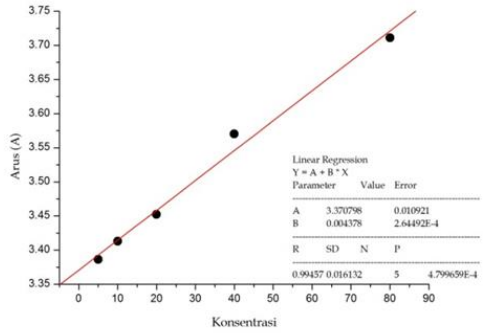

Figure-1 Standard Curve of Cr^{3+}

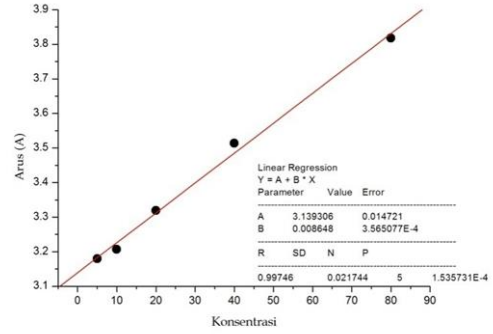

Figure-2 Standard Curve ofCr^{6+}

By entering the data from the current strength obtained from each sample or foodstuff tested using voltammeter into the equation Y = 3.370798x + 0.004378 for the determination of Cr^{3+} and Y = 3.139306x + 0.008648 for the determination of Cr^{6+} then the data obtained as shown in Table-1 and -2.

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Table 1 Content of Cr^{3+} Determined from Various Foodstuffs.

Groups	Name of foodstuffs		**Cr^{3+} (10^{-4}%)**
Vegetable group	Broccoli	Brassica oleraceavaritalica	116
	Celery	Apiumgraveolens L	96
	Snake grass	*Clinacanthusnutanslindau*	82
	green mustard	Brassica rapavarparachinensis	96
	lettuce	Lactuca sativa	136
	Cauliflower	Brassica oleraceavarBotrytis	280
	Chinese cabbage	Brassica juncea	176
Group of fruit	Tomatoes	Licopersicumesculentum	141
	Carrots	Daucuscarota	110
	Long beans	Vignasinensis	20
	Chili	Capsicum frutescens	70
Group of rice /cereals	black rice	Oryza sativa L	20
	Black sticky rice	Oryza sativa varglutinosa	21
	Brown rice	Oryzapunctata	19
	Green beans	Oryza sativa	18
	White rice	Phaseolusaureus	20
	Red beans	Vignaangularis	18
Group of tubers	Potatoes	Solanumtuberosum L	83
	Cassava	Manihotutilissima	41
Group of yeast	Yeast (bakery's yeast)	Saccharomyces cerevisiae	16
	Yeast extract commercial sample	Saccharomyces cerevisiae	18

Table 2 Content of Cr^{6+} Determined from Various Foodstuffs.

Groups	Name of foodstuffs		**Cr^{6+} (10^{-4} %)**
Vegetable group	Broccoli	Brassica oleraceavaritalica	54
	Celery	Apiumgraveolens L	45
	Snake grass	*Clinacanthusnutanslindau*	39
	green mustard	Brassica rapavarparachinensis	45
	lettuce	Lactuca sativa	64
	Cauliflower	Brassica oleraceavarBotrytis	83
	Chinese cabbage	Brassica juncea	39
Group of fruit	Tomatoes	Licopersicumesculentum	66
	Carrots	Daucuscarota	132
	Long beans	Vignasinensis	52
	Chili	Capsicum frutescens	33
Group of rice /cereals	black rice	Oryza sativa L	9
	Black sticky rice	Oryza sativa varglutinosa	10
	Brown rice	Oryzapunctata	9
	Green beans	Oryza sativa	9

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	White rice	Phaseolusaureus	9
	Red beans	Vignaangularis	9
Group of tubers	Potatoes	Solanumtuberosum L	19
	Cassava	Manihotutilissima	8
Group of yeast	Yeast (bakery's yeast)	Saccharomyces cerevisiae	8
	Yeast extract commercial sample	Saccharomyces cerevisiae	9

Based on the data in Tables-1, and Table-2, it appears that for the vegetable group Cr^{3+} content ranges from 82 x 10^{-4}% to 280 x 10^{-4}%. Cauliflower has the highest Cr^{3+} content, which is 280 x 10^{-4}%.While snake grass, has the smallest content, which is 82 x 10^{-4}%. Snake grass is a local crop that is believed to be useful for treating diabetes mellitus. Groups of fruits contain Cr^{3+} ranging from 20 x 10^{-4}% to 141 x 10^{-4}%. Tomato fruit has the highest Cr^{3+} content, which is 141 x 10^{-4}%. While the long bean, has the smallest content, which is 20 x 10^{-4}%. The black rice has the highest Cr^{3+} content, which is 21 x 10^{-4}%. While green beans and red beans, has the smallest content, which is 18 x 10^{-4}%. Tuber groups contain Cr^{3+} ranging from 41 x 10^{-4}% to 83 x 10^{-4}%. Potatoes have the highest Cr^{3+} content, which is 83 x 10^{-4}%. While cassava has the smallest content, which amount to 41x 10^{-4}%.The yeast group has Cr^{3+} content ranging from 16 x 10^{-4}% to 18 x 10^{-4}%.The commercial yeast extract which is thought to be made of brewery yeast has the highest Cr^{3+} content, which is 18 x 10^{-4}%. While yeast (bakery yeast/yeast bread), has the smallest content, which is 18 x 10^{-4}%. Based on the findings in this study, it can be concluded that the vegetable group has the highest Cr^{3+} levels among the foodstuffs tested, especially cauliflower.

Based on the data in Table -2, it can be seen that for the vegetable group Cr^{6+} content ranges from 39 x 10^{-4}% to 83 x 10^{-4}%. Cauliflower has the highest Cr^{6+}content, which is 83 x 10^{-4}% while the chicory and snake grass have the smallest content, which is 39 x 10^{-4}%. The fruit group contained Cr^{6+} ranging from 33 x 10^{-4}% to 132 x 10^{-4}%.Carrot fruit has the highest Cr^{6+} content, which is 132 x 10^{-4}% while chili has the smallest content, which is equal to 33 x 10^{-4}%. The rice/cereals group contained Cr^{6+} ranging from 9 x 10^{-4}% to 10 x 10^{-4}%. Black rice has the highest Cr^{6+} content, which is 10 x 10^{-4}% whereas white rice, brown rice, black sticky rice, green beans and red beans contain 9 x 10^{-4}%. Tuber groups contain Cr^{6+} ranging from 8 x 10^{-4}% to 19 x 10^{-4}%. Potatoes have the highest Cr^{6+} content, which is 8 x 10^{-4}% while cassava has a content of 19 x 10^{-4}%. The yeast group has a Cr^{6+} content ranging from 8 x 10^{-4}% to 9 x 10^{-4}%. Commercial yeast extract has the highest Cr^{6+} content, which is 9 x 10^{-4}% while yeast (bakery yeast/baker yeast) is 8 x 10^{-4}%. Based on the findings in this study, it can be concluded that carrots have the highest Cr^{6+} content among the foodstuffs tested.

4. CONCLUSION

The results showed that foodstuffs containing the highest Cr^{3+} were cauliflower having 280 x 10^{-4}%, but Cr^{6+} was 83 x 10^{-4} %. Foodstuffs that have a small Cr^{6+} content are cassava, nuts and commercial yeast, which range from 8 x 10^{-4}% to 9 x 10^{-4} % but Cr^{3+} content is not very high, ranging from 18 x 10^{-4}% to 20 x 10^{-4}%.

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