

Determination of Some Heavy Metal Levels in Soft Drinks from Turkey Using ICP-OES Method

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Abstract

BINGÖL M., YENTÜR G., ER B., ÖKTEM A.B. (2010): Determination of some heavy metal levels in soft drinks from Turkey using ICP/OES method. Czech J. Food Sci., 28: 213–216.

Total number of 104 canned soft drinks collected from several regions in Turkey were analysed. The purpose of this study was to determine the levels of heavy metals in the drinks commonly consumed in Turkey. Quantitative determination of heavy metals: arsenic, copper, zinc, cadmium, and lead in all samples was carried out by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry) method. The mean levels (\pm SE) of arsenic, copper, zinc, cadmium, and lead were found to be 0.037 ± 0.002 mg/kg, 0.070 ± 0.009 mg/kg, 0.143 ± 0.012 mg/kg, 0.005 ± 0.0003 mg/kg, and 0.029 ± 0.002 mg/kg, respectively, in soft drinks. Our data revealed that arsenic, copper, zinc, cadmium, and lead mean levels found in all soft drinks, collected from several regions in Turkey, were within the Turkish Food Codex (TFC) values.

Keywords: heavy metals; soft drinks; ICP-OES

Environmental pollution is the main cause of heavy metal contamination in the food chain. Lead and cadmium are two potentially harmful metals that have aroused considerable concern (CARRERA *et al.* 1995). Atmospheric contamination, the excessive use of fertilisers and pesticides, and sewage sludge or irrigation with residual waters is among the causes of contamination of raw foodstuffs (DEMİRÖZÜ & SILDAMLİ 2002). As a result of the soil, atmosphere, underground and surface water pollution, our foods and beverages are getting contaminated with heavy metals (KREJPCIO *et al.* 2005).

Pb and Cd toxicity is well documented and is recognised as a major environmental health risk throughout the world. Lead affects humans and animals of all ages, however, the effects of lead are most serious in young children. Cadmium is a toxic and carcinogenic element (KREJPCIO *et al.* 2005; RUBIO *et al.* 2006). Because of their high toxicity, arsenic,

lead and cadmium need to be quantified in food and beverages (BARRASTE *et al.* 2003). Cadmium intake in relatively high amounts can be detrimental to human health. Over a long period of intake, cadmium may accumulate in the kidney and liver and, because of its long biological half life, may lead to kidney damage (MADUASUCHI *et al.* 2006).

Heavy metals composition of foods is of interest because of their essential or toxic nature. For example, iron, zinc, copper, chromium, cobalt, and manganese are essential, while lead, cadmium, nickel, and mercury are toxic at certain levels (ONIANWA *et al.* 1999). Arsenic is a highly toxic element and its presence in food composites is a matter of concern to the humans well-being (AL RMAILI *et al.* 2005). After acute and chronic exposures, it causes a variety of adverse health effects to humans such as dermal changes, respiratory, pulmonary, cardiovascular, gastrointestinal, hemato-

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Arsenic Toxicity Narayan Chakrabarty, 2015-08-05 The most talked about metalloid in the modern world arsenic affects the liver kidney and lungs leads to cardiovascular diseases cancer and diabetes and may cause blindness with long time exposure With naturally occurring arsenic boosted by mining and other industrial processes contaminating soil and drinking water arsenic toxicity is a maj

Heavy Metals in the Environment Vinod Kumar, Anket Sharma, Artemi Cerda, 2020-11-21 Heavy Metals in the Environment Impact Assessment and Remediation synthesizes both fundamental concepts of heavy metal pollutants and state of the art techniques and technologies for assessment and remediation The book discusses the sources origin and health risk assessment of heavy metals as well as the application of GIS remote sensing and multivariate techniques in the assessment of heavy metals The various contamination indices like contamination factor geoaccumulation index enrichment factor and pollution index ecological risk index are also included to provide further context on the state of heavy metals in the environment Covering a variety of approaches techniques and scenarios this book is a key resource for environmental scientists and policymakers working to address environmental pollutants Covers state of the art techniques for the assessment and remediation of heavy metals Presents the interdisciplinary impacts of heavy metals including human health ecosystems and water quality Includes various contamination indices such as contamination factor geoaccumulation index enrichment factor pollution index and ecological risk index

Practical Food Safety Rajeev Bhat, Vicente M. Gómez-López, 2014-03-31 The past few years have witnessed an upsurge in incidences relating to food safety issues which are all attributed to different factors Today with the increase in knowledge and available databases on food safety issues the world is witnessing tremendous efforts towards the development of new economical and environmentally friendly techniques for maintaining the quality of perishable foods and agro based commodities The intensification of food safety concerns reflects a major global awareness of foods in world trade Several recommendations have been put forward by various world governing bodies and committees to solve food safety issues which are all mainly targeted at benefiting consumers In addition economic losses and instability to a particular nation or region caused by food safety issues can be huge Various non dependent risk factors can be involved with regard to food safety in a wide range of food commodities such as fresh fruits vegetables seafood poultry meat and meat products Additionally food safety issues involves a wide array of issues including processed foods packaging post harvest preservation microbial growth and spoilage food poisoning handling at the manufacturing units food additives presence of banned chemicals and drugs and more Rapid change in climatic conditions is also playing a pivotal role with regard to food safety issues and increasing the anxiety about our ability to feed the world safely Practical Food Safety Contemporary Issues and Future Directions takes a multi faceted approach to the subject of food safety covering various aspects ranging from microbiological to chemical issues and from basic knowledge to future perspectives This is a book exclusively designed to simultaneously encourage consideration of the present knowledge and

future possibilities of food safety This book also covers the classic topics required for all books on food safety and encompasses the most recent updates in the field Leading researchers have addressed new issues and have put forth novel research findings that will affect the world in the future and suggesting how these should be faced This book will be useful for researchers engaged in the field of food science and food safety food industry personnel engaged in safety aspects and governmental and non governmental agencies involved in establishing guidelines towards establishing safety measures for food and agricultural commodities

Plant Growth Promoting Rhizobacteria for Sustainable Stress Management R. Z. Sayyed, Naveen Kumar Arora, M. S. Reddy, 2019-08-28 Increasing agro productivity to feed a growing global population under the present climate scenario requires optimizing the use of resources and adopting sustainable agricultural production This can be achieved by using plant beneficial bacteria i e those bacteria that enhance plant growth under abiotic stress conditions and more specifically microorganisms such as plant growth promoting rhizobacteria PGPR which are the most promising candidates in this regard Attaining sustainable agricultural production while preserving environmental quality agro ecosystem functions and biodiversity represents a major challenge for current agricultural practices further the traditional use of chemical inputs fertilizers pesticides nutrients etc poses serious threats to crop productivity soil fertility and the nutritional value of farm produce Given these risks managing pests and diseases maintaining agro ecosystem health and avoiding health issues for humans and animals have now become key priorities The use of PGPR as biofertilizers plant growth promoters biopesticides and soil and plant health managers has attracted considerable attention among researchers agriculturists farmers policymakers and consumers alike Using PGPR can help meet the expected demand for global agricultural productivity to feed the world s booming population which is predicted to reach roughly 9 billion by 2050 However to do so PGPR strains must be safe for the environment offer considerable plant growth promotion and biocontrol potential be compatible with useful soil rhizobacteria and be able to withstand various biotic and abiotic stresses Accordingly the book also highlights the need for better strains of PGPR to complement increasing agro productivity

Biosorption Processes for Heavy Metal Removal Saini, Pinki, 2024-03-11 Persistent and non degradable heavy metals stand as pollutants with the potential for severe ecological repercussions when released into the environment Municipal and industrial wastewater face a high risk of contamination by these hazardous substances posing a formidable challenge to water treatment technologies The imperative is clear effective and affordable methods for effluent treatment and metal recovery are essential for meeting regulatory standards and unlocking the latent value of valuable metals within the waste However new methods of accomplishing this challenge are necessary for increasing the effectiveness in both cost and application Biosorption Processes for Heavy Metal Removal comprehensively explores the imperative to remove heavy metals from waste streams It provides an insightful overview of biosorbents and biosorption technology focusing on their underlying biosorption features The compilation within this book comprises of a series of review articles delving into the current understanding of

biosorption mechanisms and biochemistry the efficacy of bacterial fungal and algal biomass and practical considerations for biosorbent preparation and engineering The physicochemical evaluations of biosorbents process optimization and factors influencing biosorption efficiency are also covered Furthermore the book explores biosorption applications for removing nutrients organic pollutants and metals in wastewater treatment across diverse contexts Geared towards administrators policymakers consultants industry professionals academicians scientists researchers and graduate and post graduate students in environmental sciences and related fields this book serves as their comprehensive reference *Sustainable Nanoremediation* Fernanda Maria Policarpo Tonelli, Arpita Roy, Khalid Rehman Hakeem, 2024-12-13 The use of nanomaterials for remediation efforts has been overlooked even though they present interesting characteristics as remediators This new book provides a valuable overview of low cost and eco friendly green synthesized nanomaterials as advantageous technology that promotes efficient nanoremediation of environmental pollution for the restoration of polluted areas It discusses the potential of nanomaterials specifically green synthesized nanomaterials as a practical and efficient solution toward sustainability The book details the advantages of green nanomaterials when compared to conventional physicochemical methods such as avoiding the use of harmful reagents and reducing toxic waste production The book addresses themes such as contaminants associated with environmental pollution and the threats to humans nanoremediation strategies that use microbes plants or amendments and nanoparticles as tools for nanoremediation and their advantageous characteristics

The Analytical Chemistry Laboratory Companion Michael D. Holloway, 2025-06-02 The Analytical Chemistry Laboratory Companion is essential for both students and professionals as it provides quick clear explanations on critical topics in analytical chemistry equipping you with the statistical tools necessary to ensure accurate and reliable data interpretation The Analytical Chemistry Laboratory Companion serves as a reference guide for students and professionals alike who need quick explanations on specific topics laboratory operations the structure of designing experiments and the use of statistics to gain increased accuracy precision repeatability and reproducibility of data This volume will also provide in depth and advanced studies and build the necessary background knowledge for success in the field This companion provides a concise examination of the various analytical tools used for chemistry and defines basic analytical instrument principles techniques and applications in addition to exploring statistical tools useful in data interpretation test result reporting and common root causes for faulty data with suggested remedies The introduction provides a concise guide on foundational topics such as developing standard operating procedures laboratory safety instrumental analytical methods and common statistical tools useful for data interpretation This companion covers both wet chemical and instrumental analysis including their principles applications and pitfalls The Analytical Chemistry Laboratory Companion is a must have comprehensive guide in the field of analytical chemistry **Advances in Food Diagnostics** Fidel Toldrá, Leo M. L. Nollet, 2017-06-26 Still the most up to date comprehensive and authoritative book on food diagnostics available Featuring seven entirely new

chapters the second edition of this critically acclaimed guide has been extensively revised and updated Once again delivering food professionals the latest advances in food diagnostics and analysis the book approaches the topic in several different ways reviewing novel technologies to evaluate fresh products describing and analysing in depth specific modern diagnostics providing analyses of data processing and discussing global marketing with insights into future trends Written by an international team of experts this volume not only covers most conventional lab based analytical methods but also focuses on leading edge technologies which are being or are about to be introduced Advances in Food Diagnostics Second Edition Covers ultrasound RMN chromatography electronic noses immunology GMO detection and microbiological and molecular methodologies for rapid detection of pathogens Explores the principles and applications of immunodiagnostics in food safety and the use of molecular biology to detect and characterize foodborne pathogens Includes DNA based and protein based technologies to detect and identify genetically modified food or food components Focuses on the translation of diagnostics tests from bench to the market in order to illustrate the benefits to the food industry Provides an overview of the business end of food diagnostics identifying the markets delineating the sellers and the buyers comparing current technology with traditional methods certifying operations and procedures and analysing diagnostic devices within the food and related industries This is an indispensable resource for food scientists food quality analysts food microbiologists and food safety professionals It also belongs on the reference shelves of labs conducting food diagnostics for the analysis of the sensory quality and safety aspects of food

Focus on Childhood Lead Poisoning Prevention, 1984 Evaluation Technologies for Food Quality Jian Zhong,Xichang Wang,2019-04-16 Evaluation Technologies for Food Quality summarizes food quality evaluation technologies which include sensory evaluation techniques and chemical and physical analysis In particular the book introduces many novel micro and nano evaluation techniques such as atomic force microscopy scanning electron microscopy and other nanomaterial based methods All topics cover basic principles procedures advantages limitations recent technology development and application progress in different types of foods This book is a valuable resource for scientists in the field of food science engineering and professionals in the food industry as well as for undergraduate and postgraduate students studying food quality evaluation technology Explains basic principles procedures advantages limitations and current applications of recent food quality technologies Provides guidance on the understanding and application of food quality evaluation technology in the field of food research and food industry Introduces many novel micro nano evaluation techniques such as atomic force and scanning electron microscopies and other nanomaterial based methods *Digital Gastronomy: From 3d Food Printing To Personalized Nutrition* Chee Kai Chua,Wai Yee Yeong,Hong Wei Tan,Yi Zhang,U-xuan Tan,Chen Huei Leo,Michinao Hashimoto,Gladys Hooi Chuan Wong,Justin Jia Yao Tan,Aakanksha Pant,2022-08-05 The food industry has seen many changes over the last several decades new technologies have been introduced into the way we cook manufacture and present food products to consumers Digital gastronomy which combines new computational abilities such

as three dimensional 3D printing with traditional food preparation has allowed consumers to design and manufacture food with personalized shapes colours textures and even nutrition In addition to the personalization of food 3D printing of food has other advantages such as promoting automation in food preparation and food sustainability through 3D printed cell based meats and alternative proteins Entire meals can be constructed just by 3D food printing alone In this textbook the background principles commercial food printers materials regulations business development as well as the emerging technologies and future outlook of 3D food printing are explored In terms of 3D printed materials four main classes are reviewed namely desserts snacks comprising dairy products chocolate sugars and dough fruits vegetables meats alternative proteins and pharmaceuticals nutraceuticals This textbook has been written to offer readers keen to learn more about 3D food printing in terms of concepts processes applications and developments of 3D food printing No prior knowledge is required At the end of each chapter a set of problems offers undergraduate and postgraduate students practice on the main ideas discussed within the chapter For tertiary level lecturers and university professors the topic on 3D food printing can be associated to other subjects in food and nutrition pharmaceutical and nutraceutical sciences and food engineering Related Link s [Cumulated Index Medicus](#) ,1994 *Quality Control in the Beverage Industry* Alexandru Grumezescu,Alina Maria Holban,2019-08-15 *Quality Control in the Beverage Industry* volume 17 in the Science of Beverages series presents a detailed account of the most common aspects and challenges relating to quality control It covers the latest global trends in how to improve beverages using assessment tools authenticity approaches and novel quality control technologies The book presents a great hands on approach for anyone who needs to understand the big picture regarding analytical methods Topics covered include safety the economic impacts of contamination and detection techniques Provides tools to assess and measure sulfites in beverages using different instrumental techniques Presents the application of nanotechnology for the improvement of beverages including taste structure and overall quality Includes analytical procedures for measuring and controlling quality

Handbook of Mineral Elements in Food Miguel de la Guardia,Salvador Garrigues,2015-05-06 Mineral elements are found in foods and drink of all different types from drinking water through to mothers milk The search for mineral elements has shown that many trace and ultratrace level elements presented in food are required for a healthy life By identifying and analysing these elements it is possible to evaluate them for their specific health giving properties and conversely to isolate their less desirable properties with a view to reducing or removing them altogether from some foods The analysis of mineral elements requires a number of different techniques some methods may be suitable for one food type yet completely unsuited to another The Handbook of Mineral Elements in Food is the first book to bring together the analytical techniques the regulatory and legislative framework and the widest possible range of food types into one comprehensive handbook for food scientists and technologists Much of the book is based on the authors own data most of which is previously unpublished making the Handbook of Mineral Elements in Food a vital and up to the minute reference for food scientists in industry and

academia alike Analytical chemists nutritionists and food policy makers will also find it an invaluable resource Showcasing contributions from international researchers and constituting a major resource for our future understanding of the topic the Handbook of Mineral Elements in Food is an essential reference and should be found wherever food science and technology are researched and taught **A Bibliography for Lead** ,1986 *Nanocomposites for Pollution Control* Chaudhery

Mustansar Hussain,Ajay Kumar Mishra,2018-04-24 Nanocomposites present outstanding mechanical properties and compatibility owing to their composite matrix and unique physical and chemical composition provided by large surface area to volume ratios and high interfacial reactivity Freedom to functionalize nanocomposites with various chemical groups increases their affinity toward target pollutants which is highly desirable for the selective extraction of target analytes in complex environmental matrixes This book presents the recent progress in the field of nanocomposites and their properties fabrication methods and applications for pollution control and sensing It discusses the advances in pollution control techniques made possible because of nanocomposites and focuses on environment friendly and efficient approaches The text also covers economic toxicological and regulatory issues and research trends **TEXT BOOK OF MODERN**

PHARMACEUTICAL ANALYTICAL TECHNIQUES Dr. Amit Semwal, Dr. Renu Solanki, Dr. Noel Rahul Shaw, Dr. Prashant Kumar Desai, Dr. Narendra Kumar Nyola,2025-06-06 The Textbook of Modern Pharmaceutical Analytical Techniques provides a comprehensive and methodical understanding of various analytical tools crucial for pharmaceutical research and quality control It begins with fundamental spectroscopic methods such as UV Visible and IR spectroscopy detailing their theory instrumentation solvent effects and practical applications in pharmaceutical analysis The book progresses to advanced techniques like NMR and Mass Spectroscopy offering insights into their principles structural elucidation capabilities and technical aspects like ionization methods and analyzers Spectrofluorimetry and atomic techniques such as Flame Emission and Atomic Absorption Spectroscopy are thoroughly discussed including their instrumentation and interferences A major highlight is the detailed section on Chromatography covering a wide array of techniques paper TLC ion exchange column gas HPLC and affinity chromatography along with their principles resolution factors and pharmaceutical applications The textbook also includes Electrophoresis methods explaining paper gel capillary and iso electric focusing techniques each with working conditions and analytical significance The chapter on X ray Crystallography provides foundational knowledge on crystal structures Bragg s law and diffraction techniques essential for drug molecule characterization Finally it explores Immunological assays like RIA ELISA and bioluminescence assays underscoring their critical role in diagnostic and therapeutic monitoring This book is not only a valuable academic resource for pharmacy and analytical chemistry students but also serves as a practical guide for laboratory professionals involved in pharmaceutical quality assurance and research Through clear explanations and structured content it bridges theoretical concepts with real world analytical challenges in the pharmaceutical industry **Citrus Fruits and Juice** Arun Kumar Gupta,Jasmeet Kour,Poonam Mishra,2024-03-18 This

book provides a comprehensive overview of current scientific research on citrus juice and by product technologies It covers various aspects of citrus and its processing encompassing biochemistry advanced juice processing technology and health considerations The book also delves into testing methodologies for various chemicals phytochemicals and bitter compounds Furthermore it presents innovative and efficient methods for the detection quantification and removal of bitter chemicals to enhance the commercial appeal of bitter cultivars A special emphasis is placed on non thermal processing exploring the multifaceted aspects of citrus juice processing including by products In addition the book addresses the safety aspects of processed juice and related products a topic often overlooked in other works It particularly highlights the packaging requirements for juice and related goods This book is tailored for researchers students and professionals in the food processing industry

Encyclopedia of Chromatography Jack Cazes, 2009-10-12 Thoroughly revised and expanded this third edition offers illustrative tables and figures to clarify technical points in the articles and provides a valuable reader friendly reference for all those who employ chromatographic methods for analysis of complex mixtures of substances An authoritative source of information this introductory guide to specific chromatographic techniques and theory discusses the relevant science and technology offering key references for analyzing specific chemicals and applications in industry and focusing on emerging technologies and uses

Better Health through Natural Healing, Third Edition Ross Trattler, N.D., D.O., Shea Trattler, 2013-11-05 The definitive reference book for alternative medicine health and healing nutrition herbs and herbal medicine and natural health care is fully updated in this third edition First published in 1985 Better Health through Natural Healing has become one of the most successful and authoritative resources of its type with more than 1 5 million copies sold worldwide Since the original publication of this comprehensive guide alternative therapies have become more and more accepted by the mainstream and patients and practitioners of the wider medical community are embracing complementary medicine as an effective treatment option for a range of medical conditions This third edition has been fully revised by Dr Ross Trattler with the assistance of his son osteopath Shea Trattler to encompass recent developments in holistic medicine and healing The first part of the book clearly explains the principles of natural medicine including diet osteopathy naturopathy botanical medicine hydrotherapy physiotherapy and homoeopathy The second part offers practical advice for the treatment of over 100 common diseases and ailments that individuals and families face The A Z compendium ranges from acne and alcoholism to menstrual disorders and migraines to warts and whooping cough A comprehensive self help guide to natural medicine Better Health through Natural Healing is an essential reference book for health care practitioners and for anyone seeking to heal illness effectively with natural treatments

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