

Comparison of AOAC, Microwave and Vacuum Oven Methods for Determining Total Solids in Milk

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ABSTRACT

A collaborative study was conducted on fluid milk for total solids measurement by a microwave oven and the AOAC method. The microwave oven method performed better than the AOAC method in repeatability and reproducibility of total solids measurement. In addition, comparative tests of the AOAC, microwave and vacuum oven methods showed high correlation coefficients between the methods. It was also observed that the microwave and vacuum oven methods consistently measured about 0.2% higher in total solids than did the AOAC method. This tendency may be attributed to the browning which occurred with the AOAC method.

California dairy processors pay dairy farmers for milk on the basis of fat and solids-not-fat contents. There are several methods of measuring solids-not-fat. One of the methods is to obtain solids-not-fat by subtracting fat from total solids measured by the AOAC method (2). However, the AOAC method requires about 4 h in the procedures. The California dairy industry has considered the microwave oven method as a potential rapid method for use in the payment of milk and standardizing milk products.

To evaluate the microwave oven method, collaborative tests were conducted on fluid milk for total solids measurement by the microwave oven and AOAC methods. The California Department of Food and Agriculture Dairy Laboratory and one industry laboratory participated in the tests. From the collaborative test results, repeatability and reproducibility (5) of the AOAC and microwave oven methods were estimated. In addition, the State Laboratory made comparative tests of the AOAC, microwave and vacuum oven methods for correlations between pairs of the methods.

MATERIALS AND METHODS

Collaborative study

Seventeen samples of fluid milk were prepared by the State Laboratory and shipped to the industry laboratory with instructions for the analyses. The milk samples ranged from 9.59 to 14.56% total solids. All analyses were in duplicate.

Comparative tests

Twenty samples of fluid milk were prepared and analyzed in

duplicate by the State Laboratory. The milk samples ranged from 9.22 to 14.44% total solids.

AOAC method

The AOAC method is described in 16.032 of the 12th ed. (3).

Microwave oven method

The CEM Corporation Automatic Volatility Computer AVC Model MIP was used. With the microwave oven, approximately 3-4 g of milk were added to one of two faced 12.5-cm glass fiber papers; the second sheet covered the first sheet and the paper was inverted to disperse the pool of milk. The sample was immediately placed on the microwave oven balance and the oven cycle was started when the balance became stable (ca. 4 sec). The optimum time for maximum moisture evaporation was 4.5 min.

Vacuum oven method

The samples were initially evaporated to dryness on a steam bath as described in 16.032 of the AOAC methods (3), and then the moisture method, 31.005 of the AOAC methods (3), was used for vacuum drying.

RESULTS AND DISCUSSION

Collaborative study

The AOAC and microwave oven methods were evaluated on the basis of repeatability and reproducibility as defined in reference (5). Results from the microwave oven method were more repeatable and reproducible than those from the AOAC method, as shown in Table 1.

Comparative tests

The microwave and vacuum oven methods measured consistently higher in total solids than did the AOAC method. This tendency may be attributed to the browning of samples which occurred with the AOAC method. King (3) also observed the difference related to degree of the browning. Hodge (1) and Patton (4) discussed the browning in terms of lactose-protein

TABLE 1. Summary of all test results.

Statistic	AOAC method	Microwave oven	Vacuum oven
<i>Collaborative study (17 samples)</i>			
Mean of total solids			
State	12.019	12.231	—
Industry	12.064	12.155	—
Standard deviation			
Repeatability	0.0224	0.0195	—
Reproducibility	0.0675	0.0621	—
<i>Comparative study (20 samples)</i>			
Mean of total solids	12.430	12.617	12.579

*CEM Corporation, P.O. Box 9, Indian Trail, N.C., 28079. Mention of trade names does not imply endorsement by the California Department of Food and Agriculture.

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Safety Analysis of Foods of Animal Origin Leo M.L. Nollet, Fidel Toldra, 2016-04-19 We cannot control how every chef packer and food handler might safeguard or compromise the purity of our food but thanks to the tools developed through physics and nanotech and the scientific rigor of modern chemistry food industry and government safety regulators should never need to plead ignorance when it comes to safety assurance Compiled Handbook of Processed Meats and Poultry Analysis Leo M.L. Nollet, Fidel Toldra, 2008-11-12 Muscle foods include a wide range of processed meats and poultry and therefore represent an important percentage of total worldwide food consumption The sheer volume of products and the variety of processes available makes analyzing them problematic Co Edited by Fidel Toldra Recipient of the 2010 Distinguished Research Award from the American **Vitamin Analysis for the Health and Food Sciences** Ronald R. Eitenmiller, W. O. Landen Jr., Lin Ye, 2016-04-19 Employing a uniform easy to use format Vitamin Analysis for the Health and Food Sciences Second Edition provides the most current information on the methods of vitamin analysis applicable to foods supplements and pharmaceuticals Highlighting the rapid advancement of vitamin assay methodology this edition emphasizes the use of improved *Dairy Processing and Quality Assurance* Ramesh C. Chandan, Arun Kilara, Nagendra P. Shah, 2015-10-19 Dairy Processing and Quality Assurance Second Edition describes the processing and manufacturing stages of market milk and major dairy products from the receipt of raw materials to the packaging of the products including the quality assurance aspects The book begins with an overview of the dairy industry dairy production and consumption trends Next are discussions related to chemical physical and functional properties of milk microbiological considerations involved in milk processing regulatory compliance transportation to processing plants and the ingredients used in manufacture of dairy products The main section of the book is dedicated to processing and production of fluid milk products cultured milk including yogurt butter and spreads cheese evaporated and condensed milk dry milks whey and whey products ice cream and frozen desserts chilled dairy desserts nutrition and health sensory evaluation new product development strategies packaging systems non thermal preservation technologies safety and quality management systems and dairy laboratory analytical techniques This fully revised and updated edition highlights the developments which have taken place in the dairy industry since 2008 The book notably includes New regulatory developments The latest market trends New processing developments particularly with regard to yogurt and cheese products Functional aspects of probiotics prebiotics and synbiotics A new chapter on the sensory evaluation of dairy products Intended for professionals in the dairy industry Dairy Processing and Quality Assurance Second Edition will also appeal to researchers educators and students of dairy science for its contemporary information and experience based applications *Methods of Analysis of Food Components and Additives* Semih Otles, 2011-11-16 With diet health and food safety news making headlines on a regular basis the ability to separate identify and analyze the nutrients additives and toxicological compounds found in food and food components is more

important than ever This requires proper training in the application of best methods as well as efforts to improve existing meth

FDA's Regulation of Animal Drug Residues in Milk United States. Congress. House. Committee on Government Operations. Human Resources and Intergovernmental Relations Subcommittee,1990 Abstract This hearing discusses the level of animal drug residues found in milk and the Food and Drug Administration responsibilities to detect and regulate milk quality Testimony is recieved from critics of FDA practices dairy industry spokespeople directors of state dairy quality assurance programs and FDA officials

Human Milk Michelle McGuire,Deborah L. O'Connor,2020-11-22 Human Milk Sampling and Measurement of Energy Yielding Nutrients and Other Macromolecules presents comprehensive rigorous state of the science information on the origins analysis concentrations and variation in energy yielding nutrients and other macromolecules present in human milk The book includes information on how best to collect and store milk for determining concentrations of these important milk constituents and considers how to conduct milk composition analysis in research clinical and resource poor settings Written by a group of international experts who are actively conducting research related to human milk macronutrients each chapter also provides cutting edge rationale for what research is still needed in this evolving field In addition the book also outlines challenges and opportunities faced by clinicians industry leaders and regulators interested in adding these components to infant foods human milk nutrient fortifier and formula Presents analytical issues and challenges Contains information regarding optimal milk collection and storage procedures for each milk component Uses a systematic treatment of common factors relating to milk composition variation e g time postpartum maternal diet Provides a brief summary at the end of each chapter Reviews the literature related to history discovery analysis isoforms origins transport variability metabolism and research gaps

Modern Methods of Testing Milk and Milk Products Lucius Lincoln Van Slyke,1927

Food Analysis S. Suzanne Nielsen,2017-06-06 This fifth edition provides information on techniques needed to analyze foods for chemical and physical properties The book is ideal for undergraduate courses in food analysis and is also an invaluable reference to professionals in the food industry General information chapters on regulations labeling sampling and data handling provide background information for chapters on specific methods to determine chemical composition and characteristics physical properties and objectionable matter and constituents Methods of analysis covered include information on the basic principles advantages limitations and applications Sections on spectroscopy and chromatography along with chapters on techniques such as immunoassays thermal analysis and microscopy from the perspective of their use in food analysis have been expanded Instructors who adopt the textbook can contact the editor for access to a website with related teaching materials

Journal of the Association of Official Analytical Chemists Association of Official Analytical Chemists,1990

Advanced Dairy Chemistry Paul L. H. McSweeney,Patrick F. Fox,2009-04-20 The Advanced Dairy Chemistry series was first published in four volumes in the 1980s under the title Developments in Dairy Chemistry and revised in three volumes in the 1990s The series is the leading reference source on

dairy chemistry providing in depth coverage of milk proteins lipids lactose water and minor constituents Advanced Dairy Chemistry Volume 3 Lactose Water Salts and Minor Constituents Third Edition reviews the extensive literature on lactose and its significance in milk products This volume also reviews the literature on milk salts vitamins milk flavors and off flavors and the behaviour of water in dairy products Most topics covered in the second edition are retained in the current edition which has been updated and expanded considerably New chapters cover chemically and enzymatically prepared derivatives of lactose and oligosaccharides indigenous to milk P L H McSweeney Ph D is Associate Professor of Food Chemistry and P F Fox Ph D D Sc is Professor Emeritus of Food Chemistry at University College Cork Ireland Handbook of Milk Production, Quality and Nutrition Tanmoy Rana, 2025-05-15 Handbook of Milk Production Quality and Nutrition emphasizes new applications to promote healthy milk production processing and product development in the milk industry highlighting the role clean milk has in the prevention of health and disease Sections cover the general aspects of milk production and its environmental impact on animal health explain milk s global nutritional appeal and its role as a source of both macro and micronutrients for human health address issues of lactose intolerance and how this ailment is perceived globally and discuss milk s relevance on bone ocular and gut health Finally the book brings awareness to milk s microbial pathogens toxins and heavy metals and health concerns while also updating on regulatory health and nutrition claims and recent legislative developments Discusses the nutritional physiochemical and functional aspects of milk from farm to table Highlights milk s role in bone oral and gut health Details safe and clean milk production processing and quality management practices Identifies various milk adulterations and their relevance to public health **Chemical Abstracts**, 1910 *Chemical Analysis of Non-antimicrobial Veterinary Drug Residues in Food* Jack F. Kay, James D. MacNeil, Jian Wang, 2016-11-21 Provides a single source reference for readers interested in the development of analytical methods for analyzing non antimicrobial veterinary drug residues in food Provides a comprehensive set of information in the area of consumer food safety and international trade Covers general issues related to analytical quality control and quality assurance measurement uncertainty screening and confirmatory methods Details many techniques including nanotechnology and aptamer based assays covering current and potential applications for non antimicrobial veterinary drugs Provides guidance for analysis of banned drugs including natural and synthetic steroids Resorcylic acid lactones and Beta agonists Selected Technical Publications United States. Food and Drug Administration, 1975 Each no represents the results of the FDA research programs for half of the fiscal year **Selected Technical Publications**, 1975 **Animal Feed Contamination J** Fink-Gremmels, 2012-06-11 The production of animal feed increasingly relies on the global acquisition of feed material increasing the risk of chemical and microbiological contaminants being transferred into food producing animals Animal feed contamination provides a comprehensive overview of recent research into animal feed contaminants and their negative effects on both animal and human health Part one focuses on the contamination of feeds and fodder by microorganisms and

animal by products Analysis of contamination by persistent organic pollutants and toxic metals follows in part two before the problem of natural toxins is considered in part three Veterinary medicinal products as contaminants are explored in part four along with a discussion of the use of antimicrobials in animal feed Part five goes on to highlight the risk from emerging technologies Finally part six explores feed safety and quality management by considering the safe supply and management of animal feed the process of sampling for contaminant analysis and the GMP feed safety assurance scheme With its distinguished editor and international team of expert contributors Animal feed contamination is an indispensable reference work for all those responsible for food safety control in the food and feed industries as well as a key source for researchers in this area Provides a comprehensive review of research into animal feed contaminants and their negative effects on both animal and human health Examines the contamination of feeds and fodder by microorganisms and animal by products Analyses contamination by persistent organic pollutants toxic metals and natural toxins **Federal Register** ,1978

Mycotoxin Exposure and Related Diseases Susana Viegas,Ricardo Assunção,2020-05-12 Mycotoxins are considered the most frequently occurring natural contaminants in human and animal diets Considering their potential toxic and carcinogenic effects mycotoxin exposure assessment has particular importance in the context of health risk assessment The magnitude of a given exposure allows the derivation of the associated risk and the potential for the establishment of a disease Although food ingestion is considered a major route of human exposure to mycotoxins other contexts may also result in exposure such as specific occupational environments where exposure to organic dust also occurs due to the handling of organic materials Animals could be exposed to mycotoxins through consumption of contaminated feed subsequently entering in the food chain and thus constituting a source of exposure to humans Human biomonitoring is considered a new frontier for the establishment of the human internal exposure to mycotoxins Although several studies have summarized the potential outcomes associated with mycotoxin exposure major gaps in data remain in recognizing the mycotoxins that are the cause of diseases This book contributes provides research that supports the anticipation of potential consequences of the exposure of humans and animals to mycotoxins future risk assessments and the establishment of preventive measures *Food Allergen Testing* George Siragakis,Dimosthenis Kizis,2013-12-24 An in depth review of the current scientific knowledge on food allergens testing covering the major methodologies and techniques used to detect food allergens Food allergens are a series of agents mainly proteins which cause various unpleasant and sometimes clinical symptoms in humans through consumption of foods Perhaps surprisingly there are no treatments against food allergies which have been found to be 100% effective The scope for individual difference in terms of how a person reacts to a given allergen is massive making it incredibly difficult and complex to try and medicate against allergies Food Allergens Testing takes a thorough look at modern molecular biology and immunochemical techniques used to detect food allergens The eleven chapters constitute an in depth review of the current scientific knowledge on food allergens covering the major methodologies and techniques used in validated analytical

approaches The book is aimed at scientists and technical staff in the food industry and analytical laboratories who need an up to date treatment of both fundamental and applied research goals on food allergens as well as a report on the validated methods currently in use for food allergens testing

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