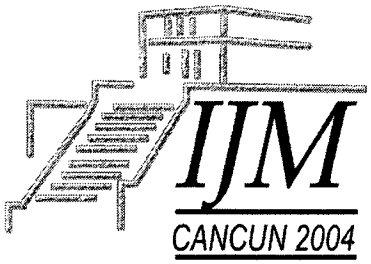
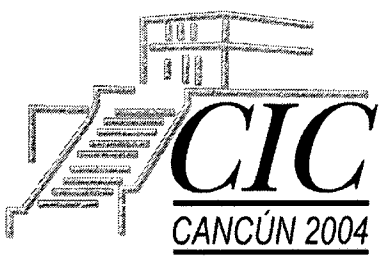


XV Annual Meeting Congreso Anual | 2004 LAS/ANS Symposium Simposio de la LAS/ANS | XXII Annual Meeting Reunion Anual

Cancun, Quintana Roo, Mexico
July 11-14 / Julio 11-14



July 11, 2004

Welcome to the Cancun 2004 International Joint Meeting (IJM). At the Cancun 2004 IJM, the Latin American Section of the American Nuclear Society, the Mexican Nuclear Society and the Mexican Radiological Safety Society are meeting from July 11th to 14th in the beautiful city of Cancun, Quintana Roo, Mexico, to celebrate the grand event "Towards Latin American Cooperation for the Development of Nuclear Energy and Radiological Safety". During this event the Mexican Nuclear Society participates in its XV Annual Meeting, the Latin American Section of the American Nuclear Society takes part in its 2004 Symposium, and the Mexican Radiological Safety Society carries out its XXII Annual Meeting.

There are nine plenary sessions scheduled, two sessions for papers by invited specialists, twelve technical sessions, four student sessions and one Laguna Verde NPP session.

The plenary sessions involve participants from renowned international organizations and include presentations about the nuclear power industry, applications of radiation, and radiological safety, all within an international context. There are two special sessions, one includes six papers about the Advances in Neutron Transport in Nuclear Engineering and another has five papers concerning In Core Fuel Management, each with the participation of specialists with international prestige. The 72 papers presented in the technical sessions are from renowned Argentinean, Brazilian, Canadian, Cuban, North American and Mexican institutions. This work exemplifies the intense research and development activity in the nuclear industry as well as in the area of radiological safety. In addition, the 23 student papers reveal the impetus that the nuclear community provides to the formation of human resources.

We wish to acknowledge everyone who has contributed to the organization, planning and production of this event which demonstrates the cooperation and friendship that exists between colleagues from different countries. A special thank you is in order for the companies and institutions that have in various ways sponsored this event, without which it would not have been possible, among other things, for the students to attend Cancun 2004 IJM.

We hope all of the conference participants as well as their families who accompany them have a pleasant stay in Cancun and in its exquisite natural and cultural surroundings.

Welcome!

The Organizing Committee of Cancun 2004 IJM

Towards Latin American Cooperation on the Development of Nuclear Energy and Radiological Safety
Hacia una Cooperación Latinoamericana para el Desarrollo de la Energía Nuclear y la Seguridad Radiológica

10437

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Distribution of Th-232 and Th-228 in Santos and São Vicente Estuary, São Paulo, Brazil

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Abstract

In the last decades considerable attention has been given to technologically enhanced natural occurring radioactive material (TENORM). Within this frame, of particular concern is the phosphate fertilizer industry. Santos Basin, located in Southwest Brazil, São Paulo State, comprising Santos and São Vicente estuarine system, is considered the most important industrial region of the country. Among the industrial activities present, phosphate fertilizer plants are responsible for the production of 69 millions tons of phosphogypsum waste, which is stockpiled in the surrounding environment. This waste concentrates radionuclides of the natural series originally present in the phosphate rock used as raw material. This study aims to evaluate the environmental impact of such activities in the sediments of the estuarine system. ^{232}Th and ^{228}Th concentrations in Santos and São Vicente estuary sediments were determined by neutron activation analysis and gamma spectrometry, respectively. ^{232}Th concentration ranged from 6.5 to 198 Bq kg^{-1}, with mean value of 57±39 Bq kg^{-1}, for 42 samples. ^{228}Th content varied from 12 to 110 Bq kg^{-1}, with a mean value of 74±23 Bq kg^{-1}, for 18 samples. It can be seen that the amount of ^{232}Th is higher in the rivers close to the phosphogypsum piles, at least five points were identified as being affected by anthropogenic factor.

1. INTRODUCTION

Thorium is an element quite insoluble in environmental conditions. Its geochemistry is basically defined by its unique valence state (4+) and low size of the ion that promote intense interaction with water and others substances forming complex ions. In solution Th precipitate rapidly due to the very low solubility product of $Th(OH)_4$ of approximately 10^{-35} [1]. The ^{232}Th content in river and near shore sediments is almost always related to weathered or detrital material, associated with heavy minerals, that formed the sediments, reflecting the local mineralogy, while ^{228}Th have an authigenic origin due to the short half-live of its parent ^{228}Ra (5.75 yr).

Human activities also contribute to the elemental composition of sediments and in some situations, give rise to the total amount of a particular element, as in the case of technologically enhanced natural occurring radioactive materials (TENORM). The contamination of land and sediments by TENORM is of major concern [2, 3, 4, 5, 6].

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Radiation Protection by Ascorbic Acid in Sodium Alginate Solutions

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Abstract

Alginates are gelling hydrocolloids extracted from brown seaweed used widely in the nourishing and pharmaceutical industries. As alginic acid gellification retard food entrance in the stomach alginate is an additive used in diets. The objective of this work was to study the protective action of the ascorbic acid in alginate solutions against the action of ^{60}Co gamma radiation. One % (w/v) solutions of alginate had been used and concentrations of ascorbic acid varied from 0 to 2.5% (w/v). The solutions were irradiated with doses up to 10 kGy. Viscosity/dose relationship and the pH of the solutions at 25°C were determined. Ascorbic acid behaved as an antioxidant against radiation oxidative shock in this model system of an irradiated viscous solution. Besides its radiation protective role on alginate solutions ascorbic acid promoted a viscosity increase in the range of concentrations employed.

1. INTRODUCTION

Alginates have a long history of use in foods and their uses are based mainly on their thickening, gelling, film formation, stabilizing and general colloidal properties. Thickening is useful in sauces, syrups and toppings for ice cream, in pie fillings it reduces moisture retention by the pastry, in cake mixes it thickens the batter aids moisture retention and in canned meat and vegetables it can give either temporary or delayed-action thickening [1]. The major matrix component in brown algae is a gelling polyuronide called alginate. Alginate forms strong gels in the presence of excess calcium cations. Guluronic acid-rich sodium alginate is more soluble in water than manuronic acid-rich sodium alginate. Solubility seems to be a leading cause of retardation of food intake in alginate diets, due to the gelling of alginic acid in the stomach. Animals fed guluronic acid-rich alginate display a significantly lower food intake and grow more slowly than those consuming manuronic acid-rich alginate. In addition, sodium alginate slows gastric evacuation in humans [2].

Ascorbic acid and tocopherols are widely distributed in human diet and have been reported to scavenge active oxygen species and prevent cell damage [3]. There are evidences that antioxidants can scavenge or quench free radicals generated by irradiation

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Calibration Methodology for Instruments utilized in X Radiation Beams, Diagnostic Level

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Abstract

Methodologies for the calibration of diagnostic radiology instruments were established at the Calibration Laboratory of IPEN. The methods may be used in the calibration procedures of survey meters used in radiation protection measurements (scattered radiation), instruments used in direct beams (attenuated and non attenuated beams) and quality control instruments. The established qualities are recommended by the international standards IEC 1267 and ISO 4037-3. Two ionization chambers were used as reference systems, one with a volume of 30 cm^3 for radiation protection measurements, and the other with a volume of 1 cm^3 for direct beam measurements. Both are traceable to the German Primary Laboratory of Physikalisch-Technische Bundesanstalt (PTB). In the case of calibration of quality control instruments, a non-invasive method using the measurement of the spectrum endpoint was established with a portable gamma and X-ray Intertechnique spectrometer system. The methods were applied to survey meters (radiation protection measurements), ionization chambers (direct beam measurements) and kVp meters (invasive and non-invasive instruments).

1. INTRODUCTION

Considering that the underlying aim in radiology is to obtain the best possible diagnostic image with the least radiation exposure to patient and staff, and that about 25% of the instruments used for routine measurements in diagnostic radiology may require some adjustments[1], the calibration of the instruments used in diagnostic radiology measurements is essential.

Special methodologies for the calibration of this kind of instruments were established at the Calibration Laboratory of IPEN[2,3,4]. The established qualities were recommended by the international standards IEC 1267[5] and ISO 4037-3[6]. The methods may be applied in the calibration procedures of survey meters used for radiation protection measurements, instruments used in direct beams, and quality control instruments.

The objective of this work is to demonstrate the established methodologies at the Calibration Laboratory of IPEN and analyse the behaviour of different instruments used in diagnostic radiology measurements.

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Assessing Antioxidant Activity of some Varieties of Gamma-Irradiated Brazilian Soybean by ESR

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Abstract

Soybean production and utilization as food has increased during the last decades. The protein and oil contents are high in quantity and quality. Soy is natural source of flavonoids - biologically active components that are thought to possess antioxidant effects in vivo and in vitro systems. Alongside traditional methods of processing and preserving food, the technology of food irradiation is gaining more and more attention around the world. This study was undertaken to investigate by means of electron paramagnetic resonance (EPR) the stability of free radicals generated by radiation processing on three different soybean cultivars. The soybean cultivars investigated were gamma-irradiated with doses of 0, 2.0, 5.0, 10.0 and 15.0kGy. Both irradiation and EPR measurements were performed at room temperature. The EPR signal intensity correlated well with the ionizing radiation dose. EPR spectra were recorded 16h, 11days and 40 days after irradiation. The results showed that the EPR signal intensities remained almost constant up to 40 days after irradiation for all the varieties assayed. Further experiments are required in order to identify the species responsible for the EPR peaks and the proper antioxidant capability of these soybean cultivars against the radiation-induced oxidative shock.

1. INTRODUCTION

Soybean production and utilization as food has increased during the last decades. Soybean has a unique chemical composition. The protein and oil contents are high in quantity and quality. Soybean seeds contain also important phytochemicals that have been shown in recent years to offer important health benefits. They are natural source of flavonoids - biologically active components which are thought to possess antioxidant effects in vivo and in vitro systems.

Dietary flavonoids represent a family of polyphenol compounds found in common food items derived from plants. Depending on structural features, flavonoids can be further subdivided into flavones, flavonols, isoflavones, flavanes, and flavanols. The biological activities of flavonoids are structure dependent and epidemiological studies support their role in human cancer prevention. Several flavonoids inhibit cancer development in animal models of chemical and UV carcinogenesis [1]. Some authors described the in vivo antioxidant activity of soy isoflavones in human subjects determined by the urinary excretion of secondary lipid peroxidation products [2].

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Gamma Scanning of Industrial Column for Water Treatment Comparing Two Scintillator Detectors: CsI(Tl) and NaI(Tl)

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Abstract

A gamma ray scanning system was developed, aiming to identify process failures in industrial columns. Two scintillator detectors: CsI(Tl) and NaI(Tl) were used for comparison. This system was tested in an industrial column for water treatment (6.5 m diameter and 40 m height). The source –detector system consists of: (1) ^{60}Co radioactive sealed source in a panoramic lead irradiator, (2) a scintillator detector coupled to a ratemeter / analyzer and (3) a mobile system. A dedicated computer with software for a data processing was used for recording in appropriate intervals and a profile of the instantaneous operation state was obtained by plotting the detector response against the column elevation. Based on the gamma ray absorption behavior of the inside medium, the density profiles of the columns were obtained. The thickness and the relative tray position column could then be clearly identified. Both, the NaI(Tl) and the CsI(Tl) detectors showed good proprieties for gamma scanning applications.

1. INTRODUCTION

Gamma scanning technique is a fast, efficient and cost–effective tool for better understanding of dynamic processes taking place in industrial columns and to examine inner details of a distillation, while it is in operation. This nondestructive technique provides an accurate density profile of an on-line process, and can be applied for troubleshooting, debottlenecking, predictive maintenance and process optimization [1].

The source selection, equipment for handling radioactive source and strategy to be adopted for inspection, vary to situation to situation. Knowledge of column internals, the process taking place inside and expertise in handling radioactive sources are essential for the analysis of scan data.

A collimated sealed source of penetrating gamma rays is allowed to pass through the shell of a vessel, is modified by the vessel internals and then comes out of the other side. By measuring the transmitted radiation intensity, valuable information can be obtained about the densities of the materials present inside the vessel. The higher the density of the material, the less radiation gets through; so significantly more gamma rays are transmitted trough a vapour compared to a liquid phase [3,4].

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Non-Food Radiation Technology Applications of Food Commodities

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Abstract

At present food irradiation is considered an effective, broad-spectrum, residue-free, mature technology. Expertise in irradiation processing exists in a network of centers around the world, some of them in developing countries like Brazil and Argentina in the South American region. The use of renewable resources coming from crops products is becoming attractive also for non-food applications. In this sense, a complete new approach of higher aggregated value of some commodities like soy and maize, for example, is as renewable resources to create functional polymers, mainly for innovative biodegradable packaging solutions. There is a need of innovative approaches to produce edible/biodegradable materials from natural polymeric macromolecules with adequate properties. Incipient researches pointed to the successful use of irradiation processing to obtain or modify different types of biodegradable/edible plastic materials. This new radiation technology application is particularly important for countries that are leading producers of soybean and other commodities.

1. INTRODUCTION

At present food irradiation is considered an effective, broad-spectrum, residue-free, mature technology which can play an important role to ensure food safety in developed as well as developing countries. It controls insect infestation, inhibits the germination of root crops, and prolongs the shelf-life of perishable produce [1]. Although some questionable and polemic experiments about the possibility of fat food-borne radiolytic compounds might promote experimental colon carcinogenesis [2] overwhelming evidences indicate that irradiated foods are safe and effective [3][4][5].

International standards to ensure the safety of irradiated products and to facilitate trade have been recommended by the Codex Alimentarius Commission which is recognized by the World Trade Organization (WTO). Good Irradiation Practices (GIPs) for a broad range of applications have been developed and widely disseminated by the International Consultative Group on Food Irradiation (ICGFI). It was established under the aegis of the Food and Agriculture Organization

* Former Brazilian Contact Point to the International Consultative Group on Food Irradiation (1993-2001)