DOWNLOAD PDF HEAVY METALS IN FOOD PACKAGINGS M. E. CONTI

Chapter 1 : Baby Food: High Level of Heavy Metals Found

Heavy metals in packaging paper by AAS: M.E. Conti and F. Botre fibres to be employed for the production of food packaging. In Italy, the use of secondary fibres for the produc-.

Hence, recycled paper production is higher in terms of volume and utilization. Recycled paper products are used in the packaging industry partially or fully. Such usage leads to the presence of heavy metals due to recycled and chemical additive sources. The present study aims at determining the amounts and also identifying the sources of heavy metals such as Pb, Cd, Zn, Ni, and Cu contained in recycled testliner TL and fluting FLT , which are main products used in production of corrugated cardboard. The metals in the structure of the paper used in packages directly or indirectly in contact with foods are heavy metals. Mean values of 2. The main sources of heavy metals are colorants, mainly consisting of conventional paint and pigments as well as spot and Pantone Matching System PMS colorants. Such re-use of materials helps to protect the environment and the natural resources and to ensure the sustainability of these raw materials. For this reason, it is desirable to minimize levels of air emissions, which may result when the ash created by the burning of recycled paper waste contains harmful and toxic substances. Another goal is to minimize levels of harmful leachate generated by landfills. Secondary fiber obtained from waste paper has, as some of its major ingredients, additives such pigments, dyes, starch, and adhesive chemicals. After manufacturing of the recycled base paper, it is also common to add dyes, pigments, and mineral products to improve surface, optical, and printing characteristics, as well as to adjust color, according to the intended usage Conti Recovered paper and cardboards are likely to contain heavy metals, such as zinc, lead, cadmium, and chromium, because these metals are present in the raw materials as a seconder fiber and the chemical additives particularly colorants used for the production and finishing of pulp and paper Ginebreda et al. The pigments that are being used in paper applications, as well as their chemical composition, cover a broad range. Some pigments are used to give high opacity to the paper, and thus, to improve the structure and the surface qualities of the paper; they may contain zinc and cadmium. They are also used for filling materials and coating formulations in the form of zinc oxide, zinc sulphide, or lithopone resulting from the combination of barium sulphate with ZnS for high-pressure laminated paper, cardboard products, and wall paper. Certain zinc oxide compounds provide photoelectrical properties for photo reproduction papers. Zinc and cadmium pigments are additives that provide fluorescent properties to the paper and increase the cohesive strength in certain coating applications on paper surfaces Conti Moreover, other chemicals are used to improve the cohesive strength and other process properties of recycled paper. Besides these, yellow and green color dyes and pigments used in the packaging result include compounds such as lead chromate, lead sulphate, and lead oxide Kim et al. The diversity of the inks in the last printing process varies according to the printing base materials and printing methods. Changes of Heavy Metal Content of Pigments Reflex blue is deep blue-violet hue and warm red red Lake C is both alkali pigments with similar printing properties as is used commonly in the PMS system J2 dizayn As shown in Table 1, each color pigment consists of mixtures of many, different heavy metals. Additionally, after some improvements were carried out in the formulation of printing inks, changes in the heavy metal content of the ink pigments decreased in some, increased in others, and did not change at all in some others Sutter In addition to the pigments used in coloring processes, fluorescent and metallic inks, which contain high amounts of heavy metals, constitute an obvious environmental risk. Fluorescent inks contain almost all color pigments. High color intensity or saturation is an important property for printing quality Sonmez Spot colors are widely used to obtain highly saturated colors in the packaging printing. PMS offers a higher degree of threat than the conventional coloring process. Many formulations containing PMS colors contain very large quantities of copper and barium and also both these metals, and each of them contain more than 40 different metals Zalewski ; Pekarovicova et al. The chemicals used during the production or finishing of papers used as packaging for food have a significant role in the interaction between the packaging and the food, which are in direct contact. The term migration signifies transfer of the chemical compounds within the structural body of the paper and cardboard packages to the food. However, packages that are in

direct contact with the food can be subject to migration of contaminants. In this type of migration, the ink compounds inadvertently migrate from the exterior surface printed outside of the package towards the interior surface which is in direct contact with the food on the bobbin or during stacking e. The present study aims at determining the amounts and sources of heavy metals such as Zn, Pb, Cd, Ni, and Cu contained in recycled test liner TL and fluting FLT , which are main products used in production of corrugated cardboard; this study also determines the suitability of the food packaging to the relevant legislation. Test liner TL Linerboard was used as a carrier paper for corrugated cardboard. Carrier cardboard or paper typically ranges between gm-2 and gm Carrier papers in the range of gm-2 are sufficient in small boxes. Liners obtained from recycled fiber are called test liners Paulapuro In the market, TL papers are mostly known as imitation craft paper and differing from FTL, during base paper production colorant pigments are added which is believed to be the reason for increase in Cd, Pb, Zn, and Cu values Tutus et al. Fluting FLT Fluting is a type of paper produced from all kinds of waste paper and used as an intermediate layer in corrugated paper by a fluting machine. Fluting is not treated with any chemical additives or processes. Compared with other papers, its strength is lower, and it is a paper of 95 gm-2 to gm-2 Leblebici The weight of the paper samples was determined using a digital balance Scaltec 31, Istanbul, Turkey with a 0. The content of heavy metals from recycle paper was evaluated. The weight of each recycled TL and FLT paper specimen, corresponding to an area of about 1 dm2 was determined. These were then cut into small pieces by hand using polyethylene gloves and then dried on dry weight basis. The samples were allowed to rest in the solution at room temperature for 24 h for total digestion. The cure and the solutions were also prepared under the same laboratory conditions. Standard Solutions and Reagents All reagents used were of analytical reagent grade. The standard solutions of the analyses for calibration were prepared as mgkg-1, as can be seen in the Table 2 Table 2. The quantities of analyzed heavy metal elements are given as mg per dm-2 paper Qa. Pb and Cd identified in the packages of recycled papers produced out of primary pulp and secondary pulp obtained from waste paper used in food packages should not exceed mg per each kg of package material. According to this regulation, the migration of package materials to the food cannot exceed ppm by weight for up to five years. In addition, according to the Turkish Food Codex, lead and arsenic cannot exceed 20 mg kg-1 and 2 mg kg-1, respectively, in egg boxes and packages containing vegetable fibers. As shown in Table 1, each color pigment consists of mixtures of many diverse heavy metals. Table 2 shows the heavy metal analysis results of the recycled test liner and fluting paper samples at different weights used as raw material by corrugated cardboard manufacturers. According to this regulation, the migration of package materials to the food cannot exceed ppm by weight up to five years. Lead is commonly used in the white inks. Substitute materials that have similar qualities may reduce the use of lead as pigment. Red, yellow, and green colored pigments may be the source of the Pb heavy metal Table ; Zalewski ; Keenan ; Kim et al. When average Pb quantities are compared with the data from the literature Duran et al. It is estimated that when the food packaging is composed partially or wholly of secondary fibers, this will reduce the possible risk. Cd Concentrations The basic structure of cadmium red and cadmium yellow, which are widely used as they have brighter colored pigments than other dyes used in fine arts, is constituted by cadmium heavy metal. It is highly preferred for printing inks; yet there are many pigments with qualities to replace it, and these are already used in many other applications Zalewski It may be the red, yellow, and blue colors affected the presence of the Cd as well Table 1; Zalewski ; Keenan ; Kim et al. Zn Concentrations Some of the Zn-based compounds used in paper production are zinc oxide and zinc sulfate. Zinc sulphate is used to increase the opacity of special papers, whereas zinc-oxide is used partially for production of photocopy paper Erkan and Malayoglu This metal is also engraved on many packaging as metal embroidery along with copper and aluminum Zalewski The maximum, minimum, and average values for Zn in the TL paper were 2. Also, the red and blue colors affected the formation of zinc at the about same rate. Cu Concentrations Although copper is quite toxic to aquatic life, it provides very important printing colorants. In the color printing process, phthalocyanine blue, which mostly gives a standard color as cyan, is an essential ingredient. It also helps in the formation of many green tones. Despite the negative effect of copper, there is no comparable option in printing Zalewski The minimum and maximum values of Cu in the TL papers were found to be The average Cu value in the test liner gm-2 papers was The FLT papers exhibited large values

with a remarkable difference from the test liner paper values, as shown in Table 3. The red pigment, as with other heavy metals formation Pb, Cd, Cr, Zn was observed to contribute in the formation of Cu metal Table 1; Zalewski ; Keenan ; Kim et al. This may be the result of the presence of multiple colorants in the waste paper pulp Table 1; Zalewski According to EN , the presence of noxious substances and other hazardous materials as constituents of packaging material or of any of the packaging components needs to be minimized with regard to their presence in emissions, ash, or leachate when packaging or residues from management operations or packaging waste are incinerated or landfilled. The values observed in this study are below the limit values that have been identified in food legislation. CONCLUSIONS The heavy metals in recycled paper and cardboard packaging used to produce corrugated cardboard and in the overall packaging industry were examined relative to their appropriateness of food packaging used in the sector. The results showed that the use of recovered paper could increase heavy metals during the recycling process. This increase in heavy metals is obviously caused by chemical additives used in the process of pulp and paper manufacturing, as well as the finishing operations of paper. The heavy metal amounts of FLT and TL papers with high grammage were higher than the those of low grammage papers. In the market, TL papers are mostly known as imitation craft paper and, differing from FTL, during base paper production colorant pigments are added. Such addition of colorants is understood to be the reason for increase in Cd, Pb, Zn, and Cu contents. Colored pigments have different sources of heavy metals. In a scale of lighter to darker colors, red chiefly, as well as green, blue, yellow and white, are included. Based on this study, it can be said that these colors were the primary sources of Pb, Cd, Zn, and Cu. Such colorants included fluorescence pigments, spot, and PMS colors. Minimizing heavy metals in the recycled paper also may be a key way to minimize heavy metals in emissions, ash, and leachate, when packaging or residues from management operations or packaging waste are incinerated or landfilled. Mineral Components in Food, J. Council of Europe, ResAP 1. Requirements specific to manufacturing and composition. Additives in the Paper Industry, B. Chem, Springer-Verlag, Heildenberg, Germany, pp. Finland 11 4 ,

Chapter 2 : Arbro & Auriga CDSCO, FDA, FSSAI & NABL accredited labs

HEAVY METALS IN FOOD PACKAGINGS THE STATE OF THE ART1 MARCELO ENRIQUE CONTI SPES - Development Studies Research Centre Sapienza, UniversitÃ di Roma, Via Del Castro Laurenziano 9, Roma, Italy.

The food packages were examined for weight, ash content, and optical properties under two different light sources. The toxic metal quantities of the packages were analyzed with the use of an inductively coupled plasma optical emission spectrometry ICP-OES. In all packages, Pb migrated into food and was found at levels that exceeded limit values. Although the amounts of Hg within the material structure were above limits in most packages, it did not migrate from the packages. Although the amount of Cd in structural packaging did not exceed the limit values, most of the migration-related values were high. The Zn concentration in packaging was substantially higher than the amount due to migration. Structural Cu values were mostly below the limit values, except in corrugated boards. Cr amounts in both packaging structure and migration were below the limit values. In all packaging, there were minimum amounts of Ni among paperboard samples and maximum amounts among corrugated boards. Al values were high among structural paper packages, as well as in migration values in paperboard packaging. In addition to these functions of food packaging, it is important for it to become a container that transports the food from the vendor to the table. It becomes both a package and at the same time a plate used on the table by preserving taste, smell, warmth, and freshness of the food in this process. During this function, it is expected that no contaminants and toxic components migrate into the food through the contact of the food with the structure of the packaging. Food packaging products containing end consumer usage areas include convenience food packages such as lahmacun, pita and pizza, tea bags, baking papers, coffee filters, wrapped solid fat packaging, sugar bags, dry packaging, and frozen food packaging, which directly get into contact with the food substances. These packaging products include paper, paperboard, and corrugated board-based substrates processed with operations such as coating, sizing which have various and different characteristics depending on the field of use. The structure of the paper is formed from pulp that may contain virgin fiber, recycled fiber, or portions of each. The virgin pulp production and bleaching process forms mainly the basic production processes and chemical components of the paper used in these processes. Being different from the virgin fiber-containing pulp, the basic components of the pulp containing recycled pulps include filler agents coming from virgin pulp, opacity and coloring pigments and dyes, binding components, and printing ink ingredients in addition to the pulp containing recycled fibers In order to improve the resistance and other properties of the paper, recycled base paper is produced with the chemical additives used. Paper and paperboard materials that are laminated with aluminum and plastic layers are used widely in food packages. According to EU , it is estimated that the per capita amount of coated paperboard packaging in direct contact with food is 4. Mineral materials called fillers are present in the structure of the paper by addition to the fiber suspension and surface coating in order to improve the appearance and qualities of the of paper and paperboard. Fillers can contribute as partial barriers to prevent migration and to preserve flavor, aroma, and freshness of the beverage liquids and similar food with oil, salt, and flavoring in the packages. The main functions of fillers used in paper are listed below: Increase in opacity, paper dimensional stability, and whiteness. Printing quality may be improved due to the smoother surface that can be achieved with the use of fillers. The addition of calcium carbonate filler, by increasing the pH of paper forming, tends to reduce the rate of degradation of paper properties due to aging. Colorants used to improve properties of optic and surface include impurities such as heavy metals such as Pb, Hg, Cd, and Cr due to the chemicals composing them. In paperboard food packaging, the printing methods and their inks are very important in their role of providing food-related information, promotional text and images, and functionality of the packaging. The structure of the printing ink varies according to the printing method. Mainly offset, gravure, and flexographic printing methods are used on food packaging. The main structure of the printing ink consists of colorants, insoluble organic and inorganic pigments, and soluble dyes. Studies have been made on the adjustment of the amount of toxic metals resulting from pigments forming colors in printing ink prescriptions. A change was found in the direction of decrease or increase in toxic metals existing as impurity

in the chemical structure of components forming colors in the development of printing ink prescriptions. In another study, red, blue, green, yellow, black, and white colour tones of tattoo inks were found to include toxic metals Pb, Hg, Zn, Cd, Cu, Ni. Toxic metal values exceeding a maximum limit of Epa legislation were found in green color tones and blue and white colors, respectively Ministry of Health Fluorescent, metallic and similar inks containing toxic metals in large proportions obviously expose individuals to environmental hazards. Spot colors are created with a pantone matching system PMS. In many PMS colors, the presence of copper, barium, or both, and more than 40 metals in a single metal, constitutes a potential health risk Zalewski The appearance of the substrates of paper-based packages are developed with coating, dyeing, and printing processes. The identification of a large part of the characterization of the packages is determined by measuring the optical properties of the colors and brightness. The other part is formed by the percentage of ash and basis weight. The chemical additive components of the processes used for improving the basic content and surface characteristics of the cardboard used in food packaging products cause risks for food safety, human health, and environmental pollution. The identification of toxic metals migrating from paper-based packages through food migration is crucial in ensuring the quality and safety of packaging and in assessing compliance with food legislation guidelines that potentially affect human health. Within the scope of this aim, the characterization of some food packaging structures and the determination of toxic metals originating from both structure and migration have been interpreted for their compliance with food legislation. In addition, the relationship between the ash, weight and optical characteristics parameters describing the structural characterization of the package and toxic metals was interpreted and also tested with Pearson correlation relationship using SPSS Samples were paper, paperboard, corrugated board wrappers, and related food packaging. At least three specimens were collected in each sample. Samples were obtained by collecting unopened food packages from fast food chains and individual ready-made food restaurants and wrapping them with PE film stretch. Different types of papers that come into contact with food directly include paper, bag, and container-type packages. At least three specimens were collected for each type of test sample. The packages were manufactured of paper, cardboard, and corrugated cardboard base materials. These are used as the main packaging materials, in addition to Al foil and polyethylene PE film side materials. The base materials are directly used individually or as laminated in combination with each other. The side materials are used together with the basic materials to enhance the appeal and the attractiveness of the packages in different functions. The packaging samples described are given in Table 1. In addition, characterization of packaging samples have been described according to their color optic properties , grammage, and ash test. The determination of toxic metal migration to the food due to the structure of the packaging was performed separately. Weight measurements were performed using a digital scale Scaltec 31, Istanbul, Turkey. Other standards used included: The optical properties test was used to make the definitions color of packaging samples. Toxic metal content Instrumentation: The samples were digested using a microwave oven Berghof, Istanbul, Turkey. Toxic metals for structural sources in packaging: Samples, whose basis weights and dry matter estimates were determined, were prepared for heavy metal analysis by manually tearing the samples with plastic gloves with 0.

Chapter 3 : Mineral Components in Foods: 1st Edition (Hardback) - Routledge

The levels of four representative heavy metalsâ€"Cd, Cr, Pb and Hgâ€"were measured by atomic absorption spectroscopy (AAS) in 15 different samples of paper boards, used as packaging materials for various pasta and cereals products.

Advanced Search Abstract The main threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury and arsenic. These metals have been extensively studied and their effects on human health regularly reviewed by international bodies such as the WHO. Heavy metals have been used by humans for thousands of years. Although several adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues, and is even increasing in some parts of the world, in particular in less developed countries, though emissions have declined in most developed countries over the last years. Cadmium compounds are currently mainly used in re-chargeable nickelâ€"cadmium batteries. Cadmium emissions have increased dramatically during the 20th century, one reason being that cadmium-containing products are rarely re-cycled, but often dumped together with household waste. Cigarette smoking is a major source of cadmium exposure. In non-smokers, food is the most important source of cadmium exposure. Recent data indicate that adverse health effects of cadmium exposure may occur at lower exposure levels than previously anticipated, primarily in the form of kidney damage but possibly also bone effects and fractures. Many individuals in Europe already exceed these exposure levels and the margin is very narrow for large groups. Therefore, measures should be taken to reduce cadmium exposure in the general population in order to minimize the risk of adverse health effects. The general population is primarily exposed to mercury via food, fish being a major source of methyl mercury exposure, and dental amalgam. The general population does not face a significant health risk from methyl mercury, although certain groups with high fish consumption may attain blood levels associated with a low risk of neurological damage to adults. Since there is a risk to the fetus in particular, pregnant women should avoid a high intake of certain fish, such as shark, swordfish and tuna; fish such as pike, walleye and bass taken from polluted fresh waters should especially be avoided. There has been a debate on the safety of dental amalgams and claims have been made that mercury from amalgam may cause a variety of diseases. However, there are no studies so far that have been able to show any associations between amalgam fillings and ill health. The general population is exposed to lead from air and food in roughly equal proportions. During the last century, lead emissions to ambient air have caused considerable pollution, mainly due to lead emissions from petrol. Children are particularly susceptible to lead exposure due to high gastrointestinal uptake and the permeable bloodâ€"brain barrier. Blood levels in children should be reduced below the levels so far considered acceptable, recent data indicating that there may be neurotoxic effects of lead at lower levels of exposure than previously anticipated. Although lead in petrol has dramatically decreased over the last decades, thereby reducing environmental exposure, phasing out any remaining uses of lead additives in motor fuels should be encouraged. The use of lead-based paints should be abandoned, and lead should not be used in food containers. In particular, the public should be aware of glazed food containers, which may leach lead into food. Exposure to arsenic is mainly via intake of food and drinking water, food being the most important source in most populations. Long-term exposure to arsenic in drinking-water is mainly related to increased risks of skin cancer, but also some other cancers, as well as other skin lesions such as hyperkeratosis and pigmentation changes. Occupational exposure to arsenic, primarily by inhalation, is causally associated with lung cancer. Clear exposureâ€"response relationships and high risks have been observed. Introduction Although there is no clear definition of what a heavy metal is, density is in most cases taken to be the defining factor. The main threats to human health from heavy metals are associated with exposure to lead, cadmium, mercury and arsenic arsenic is a metalloid, but is usually classified as a heavy metal. Heavy metals have been used in many different areas for thousands of years. Lead has been used for at least years, early applications including building materials, pigments for glazing ceramics, and pipes for transporting water. In ancient Rome, lead acetate was used to sweeten old wine, and some Romans might have consumed as much as a gram of lead a day. Mercury was allegedly used by the Romans as a salve to alleviate

teething pain in infants, and was later from the s to the late s employed as a remedy for syphilis. Although adverse health effects of heavy metals have been known for a long time, exposure to heavy metals continues and is even increasing in some areas. For example, mercury is still used in gold mining in many parts of Latin America. Arsenic is still common in wood preservatives, and tetraethyl lead remains a common additive to petrol, although this use has decreased dramatically in the developed countries. Since the middle of the 19th century, production of heavy metals increased steeply for more than years, with concomitant emissions to the environment Fig. At the end of the 20th century, however, emissions of heavy metals started to decrease in developed countries: Emissions of heavy metals to the environment occur via a wide range of processes and pathways, including to the air e. Atmospheric emissions tend to be of greatest concern in terms of human health, both because of the quantities involved and the widespread dispersion and potential for exposure that often ensues. The spatial distributions of cadmium, lead and mercury emissions to the atmosphere in Europe can be found in the Meteorological Synthesizing Centre-East MSC-E website http: Lead emissions are mainly related to road transport and thus most uniformly distributed over space. Cadmium emissions are primarily associated with non-ferrous metallurgy and fuel combustion, whereas the spatial distribution of anthropogenic mercury emissions reflects mainly the level of coal consumption in different regions. People may be exposed to potentially harmful chemical, physical and biological agents in air, food, water or soil. However, exposure does not result only from the presence of a harmful agent in the environment. The key word in the definition of exposure is contact 2. There must be contact between the agent and the outer boundary of the human body, such as the airways, the skin or the mouth. Exposure is often defined as a function of concentration and time: For exposure to happen, therefore, co-existence of heavy metals and people has to occur see Chapter 1. Cadmium Occurrence, exposure and dose Cadmium occurs naturally in ores together with zinc, lead and copper. Cadmium compounds are used as stabilizers in PVC products, colour pigment, several alloys and, now most commonly, in re-chargeable nickelâ€”cadmium batteries. Metallic cadmium has mostly been used as an anticorrosion agent cadmiation. Cadmium is also present as a pollutant in phosphate fertilizers. Notwithstanding these reductions in Europe, however, cadmium production, consumption and emissions to the environment worldwide have increased dramatically during the 20th century. Cadmium containing products are rarely re-cycled, but frequently dumped together with household waste, thereby contaminating the environment, especially if the waste is incinerated. Natural as well as anthropogenic sources of cadmium, including industrial emissions and the application of fertilizer and sewage sludge to farm land, may lead to contamination of soils, and to increased cadmium uptake by crops and vegetables, grown for human consumption. The uptake process of soil cadmium by plants is enhanced at low pH 4. Biological monitoring of cadmium in the general population has shown that cigarette smoking may cause significant increases in blood cadmium B-Cd levels, the concentrations in smokers being on average 4â€”5 times higher than those in non-smokers 4. Despite evidence of exposure from environmental tobacco smoke 5 , however, this is probably contributing little to total cadmium body burden. Food is the most important source of cadmium exposure in the general non-smoking population in most countries 6. Cadmium is present in most foodstuffs, but concentrations vary greatly, and individual intake also varies considerably due to differences in dietary habits 4. Women usually have lower daily cadmium intakes, because of lower energy consumption than men. Gastrointestinal absorption of cadmium may be influenced by nutritional factors, such as iron status 7. B-Cd generally reflects current exposure, but partly also lifetime body burden 8. The cadmium concentration in urine U-Cd is mainly influenced by the body burden, U-Cd being proportional to the kidney concentration. Smokers and people living in contaminated areas have higher urinary cadmium concentrations, smokers having about twice as high concentrations as non-smokers 4. Health effects Inhalation of cadmium fumes or particles can be life threatening, and although acute pulmonary effects and deaths are uncommon, sporadic cases still occur 9, Cadmium exposure may cause kidney damage. It has been suggested that the tubular damage is reversible 11 , but there is overwhelming evidence that the cadmium induced tubular damage is indeed irreversible 4. The initial tubular damage may progress to more severe kidney damage, and already in it was reported that some cadmium exposed workers had developed decreased glomerular filtration rate GFR This has been confirmed in later studies of occupationally exposed workers 15, An excess risk of kidney

stones, possibly related to an increased excretion of calcium in urine following the tubular damage, has been shown in several studies 4. Recently, an association between cadmium exposure and chronic renal failure [end stage renal disease ESRD] was shown Long-term high cadmium exposure may cause skeletal damage, first reported from Japan, where the itai-itai ouch-ouch disease a combination of osteomalacia and osteoporosis was discovered in the s. The exposure was caused by cadmium-contaminated water used for irrigation of local rice fields. A few studies outside Japan have reported similar findings 4. During recent years, new data have emerged suggesting that also relatively low cadmium exposure may give rise to skeletal damage, evidenced by low bone mineral density osteoporosis and fractures 18â€” Animal experiments have suggested that cadmium may be a risk factor for cardiovascular disease, but studies of humans have not been able to confirm this 4. However, a Japanese study showed an excess risk of cardiovascular mortality in cadmium-exposed persons with signs of tubular kidney damage compared to individuals without kidney damage Cancer The IARC has classified cadmium as a human carcinogen group I on the basis of sufficient evidence in both humans and experimental animals IARC, however, noted that the assessment was based on few studies of lung cancer in occupationally exposed populations, often with imperfect exposure data, and without the capability to consider possible confounding by smoking and other associated exposures such as nickel and arsenic. Cadmium has been associated with prostate cancer, but both positive and negative studies have been published. Early data indicated an association between cadmium exposure and kidney cancer Later studies have not been able clearly to confirm this, but a large multi-centre study showed a borderline significant over-all excess risk of renal-cell cancer, although a negative doseâ€”response relationship did not support a causal relation Furthermore, a population-based multicentre-study of renal cell carcinoma found an excess risk in occupationally exposed persons In summary, the evidence for cadmium as a human carcinogen is rather weak, in particular after oral exposure. Mercury Occurrence, exposure and dose The mercury compound cinnabar HgS , was used in pre-historic cave paintings for red colours, and metallic mercury was known in ancient Greece where it as well as white lead was used as a cosmetic to lighten the skin. In medicine, apart from the previously mentioned use of mercury as a cure for syphilis, mercury compounds have also been used as diuretics [calomel Hg2Cl2], and mercury amalgam is still used for filling teeth in many countries Metallic mercury is used in thermometers, barometers and instruments for measuring blood pressure. A major use of mercury is in the chlor-alkali industry, in the electrochemical process of manufacturing chlorine, where mercury is used as an electrode. The largest occupational group exposed to mercury is dental care staff. Inorganic mercury is converted to organic compounds, such as methyl mercury, which is very stable and accumulates in the food chain. Until the s, methyl mercury was commonly used for control of fungi on seed grain. The general population is primarily exposed to mercury via food, fish being a major source of methyl mercury exposure 27 , and dental amalgam. Several experimental studies have shown that mercury vapour is released from amalgam fillings, and that the release rate may increase by chewing Mercury in urine is primarily related to relatively recent exposure to inorganic compounds, whereas blood mercury may be used to identify exposure to methyl mercury. A number of studies have correlated the number of dental amalgam fillings or amalgam surfaces with the mercury content in tissues from human autopsy, as well as in samples of blood, urine and plasma Mercury in hair may be used to estimate long-term exposure, but potential contamination may make interpretation difficult. Health effects Inorganic mercury Acute mercury exposure may give rise to lung damage.

Chapter 4 : Metals as contaminants in food | European Food Safety Authority

*Full Article. Toxic Metals in Paper and Paperboard Food Packagings. GÃ¼lnur MertoÄŸlu-Elmas * and Gamze Ã‡Ä±nar. This study characterized the structure of food packages, determined the amount of toxic metals that pass through the package (due to the package's condition and contact with food), and examined the appropriateness of current food legislation.*

Print Introduction Metals such as arsenic, cadmium, lead and mercury are natural occurring chemical compounds. They can be present at various levels in the environment, e. Metals can also occur as residues in food because of their presence in the environment, as a result of human activities such as farming, industry or car exhausts or from contamination during food processing and storage. People can be exposed to these metals from the environment or by ingesting contaminated food or water. Their accumulation in the body can lead to harmful effects over time. Latest Nickel Nickel is a naturally occurring metal that is sometimes present in food and water through environmental contamination, including as a result of human activity. In the European Union, there are currently no maximum levels for nickel in food. Nickel in drinking water intended for human consumption and in natural mineral waters should not exceed 20 micrograms per litre. In February , EFSA published a scientific opinion on the risks to human health from nickel in food, particularly in vegetables, and also in drinking water. Mercury In January , EFSA published a statement on the risks and benefits of seafood, specifically related to the presence of methylmercury in food. Limiting consumption of fish species with a high methylmercury content is the most effective way to achieve the health benefits of fish whilst minimising the risks posed by excessive exposure to methylmercury. EFSA recommended that individual Member States consider their national patterns of fish consumption and assess the risk of different population groups exceeding safe levels of methylmercury while obtaining the health benefits of fish. The first opinion established a TWI for methylmercury of 1. Milestones EFSA has received requests from the European Commission or Member States to provide risk assessments on several metals as contaminants, including arsenic, cadmium, chromium, lead, mercury, nickel and uranium. EFSA also works closely with Member States and other data providers to collect data on occurrence of metals in food and feed. Chromium There are different forms of chromium. Chromium III occurs naturally and is an essential nutrient and the main form of chromium present in food. It aids normal glucose, protein, and fat metabolism. Another form, chromium VI is most commonly produced by industrial processes and is sometimes present in drinking water. In March , the CONTAM Panel published a scientific opinion on the risk to human health from chromium in food, particularly in vegetables and in bottled drinking water. Dietary exposure across all age groups is well below the TDI and therefore does not raise concerns for public health. Above average exposures for some groups, particularly infants, toddlers and other children, could be a concern but these estimates were limited by the availability of data. Arsenic Arsenic is a widely-occurring contaminant which occurs both naturally and as a result of human activity. Foodstuffs are the main source of exposure for the general population in Europe. The main sources of inorganic arsenic intake are cereal grains and cereal based products, food for special dietary uses e. In October , the CONTAM Panel adopted an opinion on arsenic in food, mainly focused on inorganic arsenic, which is the more toxic form in which arsenic can appear. The Panel recommended that exposure to inorganic arsenic should be reduced. Uranium Uranium is a naturally occurring radioactive metal, which can be found in varying concentrations in the environment, water and foodstuffs. The opinion focused on the chemical toxicity of uranium. EFSA concluded that average dietary exposure to uranium for the general population and high consumers across Europe is currently below the TDI. In specific areas where uranium concentrations in drinking water are high, the exposure estimates are close, but still below the TDI. For infants fed with infant formula made up with water containing uranium, the Panel noted that exposure in relation to body weight may be up to three times higher than for adults, and concluded that such exposure should be avoided. Cadmium Foodstuffs are the main source of cadmium exposure for the non-smoking general population. The current average dietary exposure to cadmium for adults is close to the TWI and the exposure of some subgroups, such as children, vegetarians and people living in highly contaminated areas, could exceed

the TWI. The risk of adverse effects for an individual at the current dietary exposure is low because the TWI is not based on actual kidney damage, but on an early indicator of changes in kidney function, suggesting possible kidney damage later in life. In its reassessment, however, the CONTAM Panel reaffirmed its previous conclusions that adverse effects are unlikely to occur in an individual with current dietary exposure but there is a need to reduce exposure to cadmium at the population level. Lead Lead is an environmental contaminant which occurs both naturally and through human activities such as mining. In an opinion published in April on possible health risks related to the presence of lead in food, the CONTAM Panel considered cereals, vegetables and tap water to contribute most to dietary exposure to lead for most Europeans. The Panel concluded that current levels of exposure to lead pose a low to negligible health risk for most adults but there is potential concern over possible neurodevelopmental effects in foetuses, infants and children. Food containing a contaminant to an amount unacceptable from the public health viewpoint and in particular at a toxicological level, is not to be placed on the market Contaminant levels must be kept as low as can reasonably be achieved following recommended good working practices Maximum levels must be set for certain contaminants in order to protect public health. This Regulation does not cover radioactive substances.

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8 Marcelo Enrique Conti, The content of heavy metals in food packaging paper boards: an atomic absorption spectroscopy investigation, Food Research International, , 30, 5, CrossRef 9 Marcelo E. Conti, Francesco BotrÃ¨, The content of heavy metals in food packaging paper: an atomic absorption spectroscopy investigation, Food Control.

Heavy Metals Introduction The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals e. However, at higher concentrations they can lead to poisoning. Heavy metal poisoning could result, for instance, from drinking-water contamination e. Heavy metals are dangerous because they tend to bioaccumulate. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down metabolized or excreted. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and groundwater. Environmental and health risks. Now we are going to describe the effects of the heavy metals in the environment. The three most pollutans heavy metals are Lead, Cadmium, and Mercury. Effects of Antimony on the environment Antimony is a metal used in the compound antimony trioxide, a flame retardant. It can also be found in batteries, pigments, and ceramics and glass. Exposure to high levels of antimony for short periods of time causes nausea, vomiting, and diarrhea. There is little information on the effects of long-term antimony exposure, but it is a suspected human carcinogen. Most antimony compounds do not bioaccumulate in aquatic life. Effects of Cadmium on the environment Cadmium derives its toxicological properties from its chemical similarity to zinc an essential micronutrient for plants, animals and humans. Cadmium is biopersistent and, once absorbed by an organism, remains resident for many years over decades for humans although it is eventually excreted. In humans, long-term exposure is associated with renal disfunction. High exposure can lead to obstructive lung disease and has been linked to lung cancer, although data concerning the latter are difficult to interpret due to compounding factors. Cadmium may also produce bone defects osteomalacia, osteoporosis in humans and animals. In addition, the metal can be linked to increased blood pressure and effects on the myocardium in animals, although most human data do not support these findings. The average daily intake for humans is estimated as 0. In what form is emitted Cadmium? Cadmium is produced as an inevitable by-product of zinc or occasionally lead refining, since these metals occur naturally within the raw ore. However, once collected the cadmium is relatively easy to recycle. Cadmium coatings provide good corrosion resistance, particularly in high stress environments such as marine and aerospace applications where high safety or reliability is required; the coating is preferentially corroded if damaged. Other uses of cadmium are as pigments, stabilisers for PVC, in alloys and electronic compounds. Cadmium is also present as an impurity in several products, including phosphate fertilisers, detergents and refined petroleum products. In the general, non-smoking population the major exposure pathway is through food, via the addition of cadmium to agricultural soil from various sources atmospheric deposition and fertiliser application and uptake by food and fodder crops. Additional exposure to humans arises through cadmium in ambient air and drinking water. Effects of Chromium on the environment Chromium is used in metal alloys and pigments for paints, cement, paper, rubber, and other materials. Low-level exposure can irritate the skin and cause ulceration. Long-term exposure can cause kidney and liver damage, and damage too circulatory and nerve tissue. Chromium often accumulates in aquatic life, adding to the danger of eating fish that may have been exposed to high levels of chromium. Effects of Copper on the environment Copper is an essential substance to human life, but in high doses it can cause anemia, liver and kidney damage, and stomach and intestinal irritation. Copper normally occurs in drinking water from copper pipes, as well as from additives designed to control algal growth. Effects of Lead on the environment In humans exposure to lead can result in a wide range of biological effects depending on the level and duration of exposure. Various effects occur over a broad range of doses, with the developing foetus and infant being more sensitive than the adult. High levels of exposure may result in toxic biochemical effects in humans which in turn cause problems in the

synthesis of haemoglobin, effects on the kidneys, gastrointestinal tract, joints and reproductive system, and acute or chronic damage to the nervous system. Lead poisoning, which is so severe as to cause evident illness, is now very rare indeed. At intermediate concentrations, however, there is persuasive evidence that lead can have small, subtle, subclinical effects, particularly on neuropsychological developments in children. Average daily lead intake for adults in the UK is estimated at 1. Although most people receive the bulk of their lead intake from food, in specific populations other sources may be more important, such as water in areas with lead piping and plumbosolvent water, air near point of source emissions, soil, dust, paint flakes in old houses or contaminated land. Lead in the air contributes to lead levels in food through deposition of dust and rain containing the metal, on crops and the soil. For the majority of people in the UK, however, dietary lead exposure is well below the provisional tolerable weekly intake recommended by the UN Food and Agriculture Organisation and the World Health Organisation. In what form is emitted lead? Lead in the environment arises from both natural and anthropogenic sources. Exposure can occur through drinking water, food, air, soil and dust from old paint containing lead. In the general non-smoking, adult population the major exposure pathway is from food and water. For infants up to 4 or 5 months of age, air, milk formulae and water are the significant sources. Lead is among the most recycled non-ferrous metals and its secondary production has therefore grown steadily in spite of declining lead prices. Its physical and chemical properties are applied in the manufacturing, construction and chemical industries. It is easily shaped and is malleable and ductile. There are eight broad categories of use: Effects of Mercury on the environment Mercury is a toxic substance which has no known function in human biochemistry or physiology and does not occur naturally in living organisms. Monomethylmercury causes damage to the brain and the central nervous system, while foetal and postnatal exposure have given rise to abortion, congenital malformation and development changes in young children. In what form is emitted Mercury? Mercury is a global pollutant with complex and unusual chemical and physical properties. World-wide mining of the metal leads to indirect discharges into the atmosphere. The usage of mercury is widespread in industrial processes and in various products e. It is also widely used in dentistry as an amalgam for fillings and by the pharmaceutical industry. Concern over mercury in the environment arises from the extremely toxic forms in which mercury can occur. Mercury is mostly present in the atmosphere in a relatively unreactive form as a gaseous element. The long atmospheric lifetime of the order of 1 year of its gaseous form means the emission, transport and deposition of mercury is a global issue. Natural biological processes can cause methylated forms of mercury to form which bioaccumulate over a million-fold and concentrate in living organisms, especially fish. These forms of mercury: The main pathway for mercury to humans is through the food chain and not by inhalation. The main sources of mercury emissions in the UK are from the manufacture of chlorine in mercury cells, non-ferrous metal production, coal combustion and crematoria. UK emissions of mercury are uncertain and it is estimated that the range is from 13 to 36 tonnes per year DERA. Whilst there has been a decline in the level of European emissions of mercury, emissions from outside of Europe have started to increase â€" increasing the level of ambient concentrations in the continent. Short-term overexposure to nickel is not known to cause any health problems, but long-term exposure can cause decreased body weight, heart and liver damage, and skin irritation. The EPA does not currently regulate nickel levels in drinking water. Nickel can accumulate in aquatic life, but its presence is not magnified along food chains. Effects of Selenium on the environment Selenium is needed by humans and other animals in small amounts, but in larger amounts can cause damage to the nervous system, fatigue, and irritability. Selenium accumulates in living tissue, causing high selenium content in fish and other organisms, and causing greater health problems in human over a lifetime of overexposure. These health problems include hair and fingernail loss, damage to kidney and liver tissue, damage to circulatory tissue, and more severe damage to the nervous system. Heavy Metals adsorption process: In the picture we can observe the way that follows the havy metals from the first step of the pollution to the final step in the human body by menas the food. The most importants disasters with heavy metals: The mercury accumulates in sea creatures, leading eventually to mercury poisoning in the population. Since then, Japan has had the strictest environmental laws in the industrialised world. Fish are killed over a stretch of km. The shock drives many FEA projects forwards.

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Chapter 6 : Heavy Metals in Baby Food: What You Need to Know - Consumer Reports

This trend has forced both the scientific and political communities to reconsider the safety of food paper packaging, and to define standards of quality for the secondary cellulose Food Control Volume 8 Number 3 Heavy metals in packaging paper by MS: M.E. Conti and F. Botre fibres to be employed for the production of food packaging.

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The heavy metals in recycled paper and cardboard packaging used to produce corrugated cardboard and in the overall packaging industry were examined relative to their appropriateness of food packaging used in the sector.

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The content of heavy metals in food packaging paper: an atomic absorption spectroscopy investigation Conti, M.E.; BotrÃ¨, F. Heavy metals and optical whitenings as quality parameters of recycled paper for food packaging.

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For each food, we have calculated a daily limitâ€"the number of servings a child would need to eat for the food to pose potential health risks from exposure to the three heavy metals.