Assessment of Toxic Heavy Metal Content in Children Toys

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ABSTRACT

The children toys are the most favorable things for children to play. But these children toys are not safe from toxic chemicals too. There is presence of different toxic heavy metals such as mercury, lead, barium, chromium, zinc etc. The standard value for different heavy metals is set up by the government of Nepal that came into effective from July 15, 2017. The standard was set up for the 12 toxic heavy metals as cadmium, chromium, lead, mercury, zinc, antimony, arsenic, barium, bisphenol A, bromine, selenium and phthalates. The study was focused on the study of the compliance of toxic heavy metals in children toys with the national standard. For the study total 52 toys were collected from different places of Nepal: Bhaktapur, Kathmandu, Lalitpur, Chitwan, Janakpur and Nepalgunj from the local vendors to the supermarkets. The toys were generally made up of plastic, rubber, metal, foam etc. After the collection and sampling of the toys they were tested in the lab of Nepal Handicraft Association of Nepal Bureau of Standard and Metrology (NBSM) by the X-Ray Fluorescence (XRF) technology. Among the 52 toys, no any heavy metals were detected in 15 toys and 37 toys were detected with multiple toxic heavy metals. The heavy metals detected in the toys were lead, cadmium, bromine, chromium, zinc and barium. Even most of the detected result is under the compliance it is very serious issue that the non-compliance result of heavy metals like lead is very much more (4688 ppm) than the standard value (90 ppm) in the toy: tortoise. In the same way, 22 children toys have the labelling and rest do not have the labelling. But the labelled children toys don't have the

labelling about the chemical safety. Though the national standard has been formulated the local or the parents themselves are unaware about the toxic heavy metals present in the toys. As well there has raised a big confusion in the standard of the toxic heavy metals as the new standard has been published omitting the standard of the heavy metals as phthalates, BPA, bromine and zinc. Thus, these points should be considered in order to implement the standard effectively and to save the children from the chemical hazards.

Keywords: Children toys, Heavy metal, Montessori, Standard.

1. Introduction

The U.S. Environmental Protection Agency (EPA) defines a toxic chemical as any substance which may be harmful to the environment or hazardous to your health if inhaled, ingested or absorbed through the skin. Many useful household projects contains toxic chemicals. Common examples include drain cleaner, laundry detergent, furniture polish, gasoline, pesticides, ammonia, toilet bowl cleaner, motor oil, rubbing alcohol, bleach, battery acid etc. The US Occupational Safety and Health Administration (OSHA) has identified several chemicals it considers highly hazardous and toxic.

A toy is an item that is used in play, especially one designed for such use. Different materials like wood, clay, paper, and plastic are used to make toys. Different materials like fabric, plastic, paper, rubber, etc. are used to make toys enjoyable to both young and old. Many items are designed to serve as toys, but goods produced for other purposes can also be used. (Thapa M. & Sah RC., 2013) Toys excavated from the Indus valley civilization (3010-1500 BCE) include small carts, whistles shaped like birds, and toy monkeys which could slide down a string. (MrDonn, 2008)

Generally, in world scenario, children's playing products were found to be made up of six toxic metals: antimony, arsenic, cadmium, chromium, lead, and mercury. All six metals are well-known to cause serious harms to human health, especially in children from mild pain to permanent loss of their Intelligent Quotients (IQ). While playing kids are more likely to chew objects and put their hands in their mouth thereby increasing their exposure possibilities to any substances in these products. Heavy metal toxicity can cause our mental functions, energy, nervous system, kidneys, lungs and other organ functions to decline. Heavy metals are defined as metallic elements that have a relatively high density compared to water (Fergusson,1990) The examples of the heavy metals include lead (Pb), cadmium (Cd), chromium (Cr), mercury (Hg), zinc (Zn), antimony (Sb), arsenic (Ar), barium (Ba), selenium (Se), bromine (Br), bisphenol A (BPA), phthalates etc.

Chemical safety is the application of the best practices for handling chemicals and chemistry processes to minimize risk, whether to a person, facility, or community. Chemical safety has many scientific and technical components. Among these are toxicology, ecotoxicology and the process of chemical risk assessment which requires

a detailed knowledge of exposure and of biological effects (WHO, 2013). Chemical security involves preventing illegal or antisocial use of chemicals, often by restricting access.it involves understanding the physical, chemical, and toxicological hazards of chemicals (Kemsley, 2013). SAICM overall objective is the achievement of the sound management of chemicals throughout their life cycle so that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, usually known as the Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs).

Today many types of children toys are developed that are very attractive and make easy to learn. In the same way today's parents are so busy that they feel comfortable and easy with the children toys. But we are totally unknown about the toxicity of these children toys; of which material it is made up of, what are the chemicals used in it and so on. Thus, this study will be helpful to know about the toxic level of the heavy metals used in the children toys and whether there is proper compliance monitoring of the children toy standard or not. Similarly, the modern parents would enroll their kids in a Montessori Schools where they may play and study with modern technologies but the parents are totally unaware about the toxicity level of different chemicals that may be present on the toys and the equipment that is provided to the children. And almost people are unaware about the chemical safety and so the staff of the Montessori Schools too. So, to make aware about the chemical safety and about the national standards of toxic chemicals of the children toys this study is carried out. In the same way many studies have been made regarding heavy metals in children products in many countries in other parts of world but in case of Nepal very less study has been made to date on this issue. As a result, our children are unknowingly exposed to various chemicals inbuilt in the toys. Thus, the main objective of this study is to access the toxic heavy metal contents in children toys in terms of their toxicity and national standard compliance. Along with the main objective the other associated objectives are to study the labelling of the children toys, and also to know the knowledge gaps about the children toy standard in Montessori Schools.

2. Materials and Methods

2.1 Study area

Different types of children toys such as of paper, plastic, metal, fabric, wood, rubber etc. are collected for lab analysis from different parts of the country mainly from Kathmandu valley including some toys from Nepalgunj, Chitwan and Janakpur.

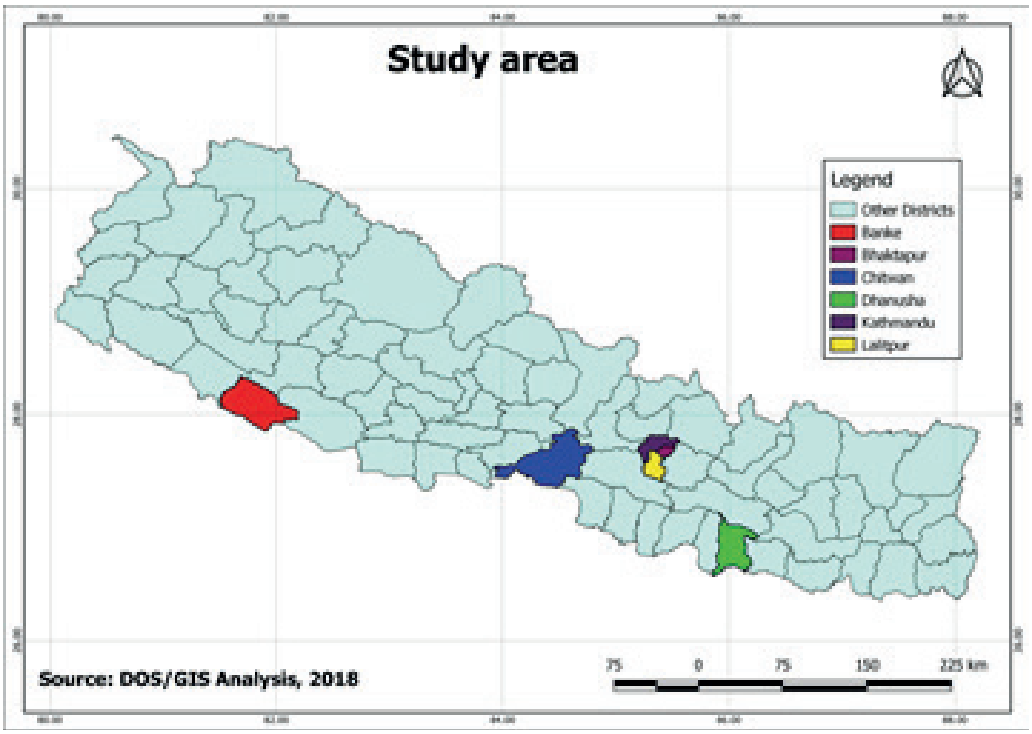


Figure 1: Study area of the collection of children toys

2.2 Sampling

As there is no any data about the number of toys produced or imported or the registered companies of the children toys, random sampling was done. A total of 52 toys samples from Nepalgunj, Janakpur, Bharatpur, Kathmandu, Lalitpur and Bhaktpur were collected randomly. Sample collection includes variety of children toys such as balls, car, guns, cock, crocodile, mobile, dog, Teddy bear, bee, cube, rattle, whistle, Camera, puzzle, building blocks, animal kits, alligator, police van, bat & ball, duck, helicopter, skipping ropes, panda, rings, giraffe, puzzle, sheep, tethers etc. While purchasing sample, color was kept in mind i.e. diversification in toy color was chosen. The sample were purchased from Super Market, Malls, Street vendor, Retailers, Dealers, Toys shops, show rooms, cosmetic shops, gift and toys shops, and educational enterprises, baby zones etc.

For the questionnaire survey of the Montessori Schools, the sample size was estimated by using the formulae given by Arkin and Colton (1963) at 95% confidence level. The total 25 Montessori Schools of Kathmandu vallley were asked the questions related to the children toys, the playing habit of the children and the knowledge towards the heavy metal content in children toys and the national standard formulated by

the government.

$$n = \frac{NZ^2P(1-P)}{Nd^2 + Z^2P(1-P)}$$

Where,

n = Sample size

d = Error limit at 5% (0.05)

Z =Confidence level (1.96)

N= Total no. of Montessori schools registered in Kathmandu, 27

P= Estimated population proportion (0.5)

By using the above formula sample size was calculated which was 25 Montessori schools.

2.3 Lab Test

Samples were coded with the help of given templates Excel Sheet and taken to the Nepal Handicraft Association and Department of Nepal Bureau of Standard and Metrology (NBSM)`s Lab for XRF (X Ray Fluorescence) Screening for heavy metals like Lead, Cadmium, Mercury, Chromium, Zinc, Selenium, Nickel, Antimony, Titanium and some other elements like Barium, Boron, Bromine. The toys were placed in the XRF machine with the right placement by focusing the light so that it can detect the heavy metals present in it. After the right placement the cover was closed and was started. With this, amount of the heavy metals was displayed in the screen.

2.4 Questionnaire survey for KAP

The questionnaire survey was carried out in statistically calculated sample size (25 Montessori schools from Kathmandu valley) through the approved questionnaires.

2.5 Data Processing, analysis and interpretation

After the lab test and the questionnaire survey, the data was arranged by using Microsoft excel. The data were further analyzed by using the statistical tool like odd ratio, chi-square test, t-test. Similarly, the data were also analyzed and interpreted by using the appropriate tools. Arc GIS 10.5 was used for the formation of map of the study area.

3. Results and Discussion

3.1 Heavy metals in the toys

From the study it has been observed that 4 chemicals are found in the children toys with the highest value of zinc (78820 ppm which is 21018.67 times higher than the standard) and lowest value of chromium (49.8 ppm which is under the compliance). In addition, the other elements like bromine has been detected in 6 toys and barium in 5 toys. However, antimony, mercury, selenium and arsenic has not been detected in any of the children toys.

Table 1: Summary of the heavy metals testing results

Elements	Detectable	Compliance	Non complaince	Range (ppm)	National Limit (ppm)	Non compliance rate (%)	Max (times more than standard)
Lead	7	46	6	86.6 - 4688	90	11.54	52.09
Cadmium	3	49	3	76.4-363	75	5.77	4.84
Chromium	4	49	3	49.8-3348	60	5.77	55.80
Zinc	25	27	25	60-78820	3.75	48.08	21018.67

The Study done in 2013 shows that some of the children toys have been detected with the maximum amount of the heavy metals but the number of toys detected with the toxic chemicals have been decreased. There was no level of mercury found in any of the children toys. Similarly, the level of lead, cadmium and bromine has also been decreased while the level of chromium seems to be increased. The toxic chemicals like zinc and barium has also been tested in this study which was not done in the study in the year 2013.

Table 2: Comparison between the study of 2013 and 2018

Chemicals studied	Chemical Range (ppm) found in toys in Nepal 2013/14	National Limit (ppm)	Chemical Range (ppm) found in toys in Nepal 2017/18
Lead (Pb)	15.2-8305.8	90	86.6-4688
Cadmium (Cd)	16.2-409.5	75	76.4-363
Chromium (Cr)	9.6-2.52.2	60	49.8-3348
Zinc (Zn)		3.75	60-78820
Mercury (Hg)	4.3	60	

In 500 children's products purchased in 5 Chinese cities: Beijing, Guangzhou, Hong Kong, Sanghai and Wuhan, 1/3 of tested products contained at least one toxic metal at the level of concern. 48 samples (9.6% of the products) contained more than one toxic metal, increasing the possibility of harm. (Greenpeace-IPEN, 2011)

In Bizerte (Tunisia), among the 24 toy samples, the most toys contained heavy metals. In addition, although both non-Poly Vinyl Chloride (PVC) and PVC made toys contained high levels of lead and cadmium, toys made with PVC have significantly higher levels of these heavy metals and therefore are far more toxic. (IPEN, 2011)

A total number of 51 toys manufactured from different countries were purchased and analysed to determine the level of lead, cadmium, chromium and nickel in the plastic components. The results obtained show that lead, cadmium, chromium and nickel were high and ranged 28.5 to 12600 mg/kg Pb; 0.15 to 9.55 mg/kg Cd; 1.30 to 394.50 mg/kg Cr, and 5.9 to 1911 mg/kg Ni. Compared with the elemental concentration threshold limits concentration (TTLC) of 90, 75 and 60 mg/kg for lead, cadmium and chromium respectively, Consumer Product Safety Commission, USA, Bureau of Indian Standard and Thailand Industrial Standard for Toys suggest that these toys are hazardous and therefore not safe for children use. This underscores the need for urgent national policy and resolution control on the removal of heavy metals especially lead from children toys. (Sindiku and Osibanjo, 2011)

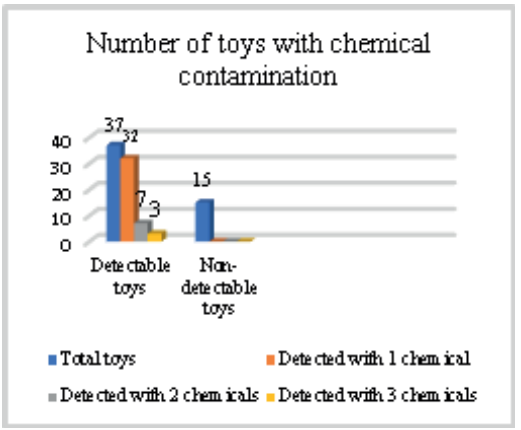
High metal contamination in toys is a widespread problem, and metals can become bioavailable, especially via oral pathway due to common child-specific behaviors of mouthing and pica. (Guney and Zagury, 2012) The presence of heavy metals in the children toys may decrease the efficiency of the children reducing their intelligence level. Similarly due to the presence of the toxic chemicals in the children toys it may also create the problem of suffocation and problem of breathing while placing these toys on their mouth too. Also, the presence of heavy metals also brings many adverse health effects such as improper growth, bone decay and so on.

3.2 Chemical contamination and labelling in children toys

From the result it was found that 15 children toys were not detected with any of the chemical that means those toys were safe from the chemical toxicity while 37 children toys were detected with any of the chemical. While among the 37 children toys, 32 toys were detected with 1 chemical beyond the compliance, 7 toys were detected with 2 chemicals and 3 toys with 3 chemicals beyond the compliance.

Among the 52 children toys studied, 22 toys have labelling where 30 children toys don't have the labelling. Among the 22 labelled toys also 17 toys have the labelling categories of choking hazard and not suitable for under 3 years, 4 toys have the labelling of not suitable for children under 3 years and 1 toy have the labelling of remove, polybag, staples and card. Similarly there are other awareness symbols used in the children toys such as disposal symbol, 3R symbol, fireproof symbol etc. Other information such as certification, cost, durability etc are also mentioned in the children toys. But about the chemical safety and about the chemical contained in the toys there is no labelling about that.

The safety symbols may include (a) intended compliance with the warning depends on the consumer's attitude towards the suitability of these toys for children under three years of age and on the type of toy, (b) the pictogram has a positive effect on intended compliance with the warning-an effect that is larger for toys perceived as less hazardous, (c) the pictogram most suited to convey the meaning consists of a 'no-parking' sign, a 'sad' face, and an age indication of 0-3. (Verma, 1996)



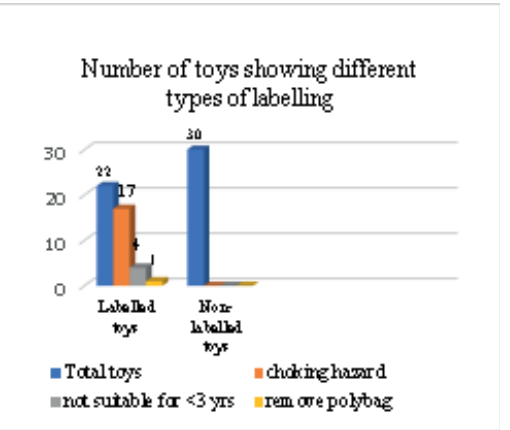


Figure 2: Number of toys with chemical contamination and labelling

3.3 Country of origin

Toys included in the study were manufactured in China (88%), India (10%) and Thailand (2%). A majority of the labeled products containing SCCPs were manufactured in China with one each manufactured in Germany, Kenya and Russia (Miller and DiGangi, 2017).Chinese made toys were analyzed to determine the levels of heavy metals (Pb, Cd, Ni, Cu, Zn, Cr, Co and Mn) in the products. Toy samples were randomly selected from products available in the shops at Zaria, Kano and Kaduna markets in Nigeria. 75% of the toys samples tested positive for PVC. Both PVC and non-PVC toys contain heavy metals but the concentration of these metals in non-PVC toys are generally less than that of PVC toys. The present study reveals that 17% of the toy samples show high concentration (above USFDA limit) of Lead, Cadmium, Chromium and other metals determined; this poses a threat to children exposed to such toys. (Omolaoye, 2010)

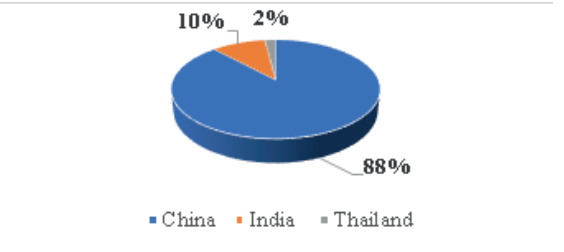


Figure 3: Country of origin of studied toys

3.4 Materials used in children toys

The children toys are made of hard plastics (50%), rubber (27%), soft plastic (7%), wood (6%), metals (4%), foam (2%) cotton (2%) and fabric (2%).

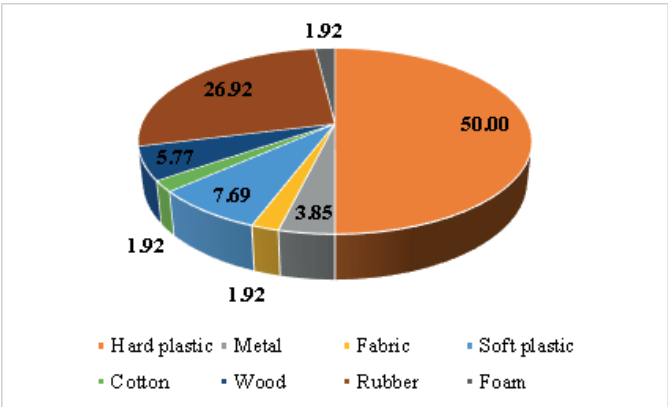


Figure 4: Materials of the studied toy samples

3.5 Material verses heavy metal

The hard-plastic toys have the very high concentration of the heavy metals like lead, chromium and zinc that are beyond the compliance rate with bromine and barium too. In the same way, the concentration of lead in the toy made up of rubber was found to be 4688 ppm which is about 52 times higher than the compliance rate of 90 ppm. From this result, the toy made up of fabric such as cotton does not have the concentration if any toxic chemical which shows that the toys are safe that are made up of our own resources.

The toys that tested positive for heavy metals, including lead, were found in every category of the product, no matter whether it was branded, cheap or expensive. (Greenpeace-IPEN, 2011).

In addition, although both non-Poly Vinyl Chloride (PVC) and PVC made toys contained high levels of lead and cadmium, toys made with PVC have significantly higher levels of these heavy metals and therefore are far more toxic. (IPEN, 2011)

Table 3: Range of different chemical as material wise of the toys

Material	Pb (90 ppm)	Cd (75 ppm)	Cr (60 ppm)	Zn (3.75ppm)
Hard plastic	86.6-328.9	0	49.8	60-1920
Soft plastic	900.2	76.4-363	1103.9	0
Metal	0	0	0	0
Wood	0	0	0	0
Fabric	0	0	0	0
Foam	0	0	0	0
Rubber	4688	92.6	74.5-3348	130-920

3.7 Knowledge of heavy metals and Government standard

Through the questionnaire survey done in 25 Montessori based schools, it is found that very less people are aware about the heavy metals and its consequences towards the human health especially children health. They are also unaware about the chemicals that are used in the children toys that they give to the children for playing or for teaching purpose may harm the intelligence level of the children too. Among the 25 schools, 15 respondents don't know about the use of heavy metals in the children toys. And who have the knowledge about the heavy metals too some have the misconception that the heavy metals are those that have heavy weight.

Nepal government has set up the national standard for the toxic chemicals used in the children toys and it has been effective from July 15, 2017. But it is a very surprising result that among the 25 schools surveyed only 8 schools are known to the national standard set up by Government of Nepal. Even these 8 schools are known to the standard they only know that the government has set up the standard but they are not aware about the knowledge of the maximum limit of the toxic chemicals that should be present in the children toys. Rest 17 schools are unaware about the national standard.

With the study done it is also found that many people have the misconception about the meaning of the heavy metals too. They think that the metals that are heavy in weight are termed as the heavy metals which are totally wrong and too aware about the meaning of the heavy metals also it is most important. In the same way people are also not ware about the standard of the toxic chemicals in the children toys.

The concern towards the national standard formulated by the government has not been a very serious issue as the presence of the toxic chemical has not led to the big accidents to the children. But we are totally unaware that the subject we are neglecting, it is creating a big and fatal issue in the development of our children; the foundation of the country resulting in the low IQ level, low performance and low intelligence level. In addition to this the government is also not active in the awareness about the impacts of the toxic chemicals and there is no strong implementation of the national standard as the information is also not effectively given to the citizen of the country.

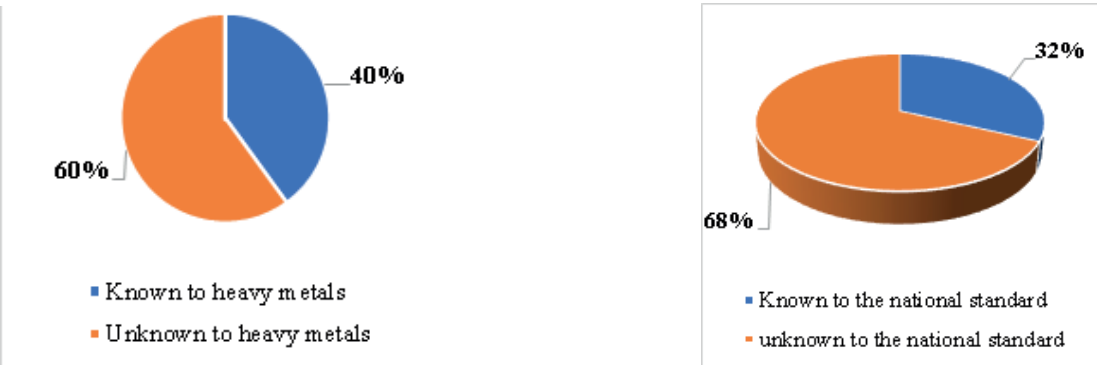


Figure 5: The knowledge about the heavy metals and national standard

3.10 Children's toy standard of Nepal 2017 and proposed regressive changes 2018

On January 16, 2017 the government of Nepal adopted a precedent-setting mandatory toy standard for 12 chemicals, including heavy metals, bisphenol A (BPA) and several phthalates, which was enforced six months later, on July 15, 2017. The standard was the first in the world to limit metals and chemicals in toys based on a total concentration standard, the same way countries regulate lead in paint. This regulatory method is rapid, easy to measure, less costly for developing countries, and clear and unambiguous for both the private sector and consumers. In contrast, the US and EU regulations are based on migration of metals in laboratory conditions. This extractable element approach is cumbersome, expensive, and relies on numerous assumptions that do not prevent exposure particularly in children.

Enacting the standard, which encompasses about a dozen toxic chemicals that hinder physical, mental and intellectual growth of children, will not only ensured their right to play safe, but will eventually minimize the negative impacts on health and environment. The standard enacted is a progressive step taken by the government of Nepal, Ministry of Population and Environment (MOPE). The Ministry has now re-structured as the Ministry of Forest and Environment (MOFE).

Even though the mandatory standard has been enacted for just one year, the compliance monitoring has already shown some improvements in the ingredients contained in children's toys. However, the government of Nepal was pressured to make changes to the existing toy standard based on an industry request.

4. Conclusions

The study shows that Nepalese children are at high risk of health hazards due to the high level of toxic chemicals in the children's products, even though the study reveals the slight improvement in the level of toxic chemicals compared to the study of 2013. Most of the children toys found in Nepalese market have highly toxic chemical such as lead (86.6ppm-4688 ppm), cadmium (76.4ppm-363 ppm), chromium (49.8ppm-3348 ppm), zinc (60ppm-78820 ppm), which significantly exceed the national standard limits set by the government of Nepal in 2017. Though majority of children toys contain toxic chemicals, there is no proper labelling about any of the toxic chemicals in most of the products. Only the teether have the labelling about the information about BPA free. Though the national standard has been implemented, the local or the parents themselves are unaware about the national standard of the toxic chemicals. As well there has raised the big confusion in the standard of the toxic chemicals that the new standard has been published omitting the toxic chemicals such as phthalates, Bisphenol A (BPA), bromine and zinc. There has not been effective implementation of the national standard in the children products. Besides, there is lack of awareness among customers, retailers and even the governmental officials about the

chemical presence in the children toys. Since the toys are manufactured with the view to attract children less than 14 years of age, children are the major affected groups of having any chances of exposure to the toxic chemicals. In the same way, majority of the Nepalese market is governed by the imported children products, it should be a matter of concern why our market is governed mostly by the imported products. We have also that ability to produce the children toys with utilizing our own resources that is less toxic as compared to the materials used in the children toys such as hard plastic and plastic based materials. Also the government needs to interrupt or intervene the market policy and set up the rules and regulations to remove the children product with chemical presence from market or reaching the market.

Acknowledgments

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Annex 1: Toxic Heavy metals and its impacts

Toxic Chemical	Health Impacts
Lead	Can cause brain development, learning and developmental problems including decreased IQ scores, shorten attention spans, attention deficit, hyperactivity, disorder and deficits in vocabulary. At high levels, lead can cause permanent brain damage and death.
Cadmium	Can cause bone pain, and fractures. Cadmium is a known carcinogen that can delay brain development in young children, hormonal effects, and altered behavior. Long-term exposure can cause cancer and kidney problems.
Mercury	Exposure to mercury can cause harmful effects, such as nerve, brain and kidney damage, lung irritation, eye irritation, skin rashes, vomiting and diarrhea, disruption of the nervous system, damage to brain functions, degradation of learning abilities, personality changes, tremors, vision changes, deafness, muscle in coordination and memory loss.

Chromium	Chromium can cause severe health effects. It can cause allergic reactions, such as skin rash. On breathing, chromium can cause nose irritations and nosebleeds. Other health problems that are caused by chromium are as: Upset stomachs and ulcers, Respiratory problems, weakened immune systems, Kidney and liver damage, Alteration of genetic material, Lung cancer and on high exposure even lead to death.
Bromine	Exposure to bromine irritates eyes and throat. Serious health effects caused by bromine are as malfunctioning of the nervous system and disturbances in genetic materials. Also they cause damage to organs such as liver, kidneys, lungs and milt.
Zinc	Zinc has many health benefits, but excessive zinc intake can be harmful. Adverse effects of severely high zinc intake may include: nausea; vomiting; loss of appetite.
Selenium	Selenium seems to increase the risk of non-melanoma skin cancer.
Arsenic	long-term exposure to high levels of arsenic is associated with higher rates of skin cancer, bladder cancer and lung cancer, as well as heart disease, change the way cells communicate, and reduce their ability to function,
Barium	Barium compounds that do not dissolve well in water, such as barium sulfate and barium carbonate, can persist for a long time in the environment. Barium carbonate can be harmful if accidentally eaten because it will dissolve in the acids within the stomach. Many hazardous waste sites contain barium compounds, and these sites may be a source of exposure for people living and working near them. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, or drinking water that is polluted with barium. People near these sites may also get soil or water that contains barium on their skin.

Nickel	In small quantities nickel is essential, but when the uptake is too high it can be a danger to human health. An uptake of too large quantities of nickel has the following consequences: Higher chances of development of lung cancer; nose cancer; larynx cancer and prostate cancer; Sickness and dizziness after exposure to nickel gas; Lung embolism; Respiratory failure; Birth defects; Asthma and chronic bronchitis; Allergic reactions such as skin rashes, mainly from jewelry and Heart disorders etc. It will pollute air, water and soil and sediments.
BPA	Bisphenol a (BPA) is the widely used chemical found in many plastics, food can linings. Known as an endocrine-disrupting chemical (EDC) that mimics the hormone estrogen, BPA has been linked to numerous negative health effects including Breast Cancer, obesity, reproductive problems, early puberty, heart disease, infertility in male and female, sparks multiple negative brain alterations.
Phthalates	Impact on neurodevelopment stage, behavioral change, aggressiveness and problems with attention. Exposures may produce developmental defects or increase the risk of diseases such as cancer later in life. Also can cause adverse impacts on the reproductive system, kidneys, liver, and respiratory system.
Polyvinyl Chloride (PVC)	Can cause cancer, birth defects, reproductive and developmental disorders, low sperm count, undescended testes and liver dysfunction

Annex 2: Standard value of heavy metals in children toys set up by government of Nepal

S. N.	Parameters	Standard (ppm) Maximum Value	Standard (mg/kg) Maximum Value
1	Cadmium (Cd)	75	75
2	Chromium (Cr)	60	60
3	Lead (Pb)	90	90
4	Mercury(Hg)	60	60

5	Zinc (Zn)	3.75	3.75
6	Antimony (Sb)	60	60
7	Arsenic (As)	25	25
8	Barium (Ba)	1000	1000
9	Selenium (Se)	500	500
10	Bromine (Br)	< 100	< 100
11	Bis Phenol A (BPA)	BPA Free	BPA Free
12	Phthalates	< 100	< 100

Annex 3: New standard proposed by Government of Nepal

S.N.	Elements	Proposed Maximum acceptable Concentration (in ppm or mg/kg of toy material)
1	Antimony (Sb)	60
2	Arsenic (As)	25
3	Barium (Ba)	1000
4	Cadmium (Cd)	75
5	Chromium (Cr)	60
6	Mercury (Hg)	60
7	Selenium (Se)	500