

Arsenic Test Kit from Cole Parmer Canada

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Arsenic is an element naturally found in the Earth's crust and can be found in various ionic states



<http://www.irinnews.org/report/94734/analysis-when-aid-meets-arsenic-nepal>

such as As 3+ and As 5+ (Dangic, 2007). This element has the ability to seep into groundwater, and can also be taken up by most crops (Dangic, 2007).

Along with impacting the quality of Nepal's water and produce, arsenic affects the health of Nepal's

population (Dangic, 2007). There has not been strong evidence provided indicating that arsenic in its organic

forms impacts Nepal's health, but there is an abundance of proof indicating that the inorganic form of arsenic could act similar to a carcinogen (Dangic, 2007). There is a strong correlation between exposure to large amounts of arsenic and the health of a person's skin and respiratory system (Dangic, 2007).

PART 1: PRODUCT INFORMATION

Arsenic test kit

An arsenic testing kit could be a potential export to Nepal. There are some general water testing kits that could test for arsenic as well as other chemicals, but an arsenic test kit is directed towards the specific element. The arsenic test kit includes test tubes, containers and chemicals that would be used during the test (Cole Parmer, 2016). The reactants provided in the kit



http://www.coleparmer.com/Product/Water_Quality_

would be in chemical form to reduce the risk of exposure (Gary, 2001). For the experiment to occur, there is a reaction between powdered zinc and acidified water (Gary, 2001). Other reagents are supplied as well to help block any interferences from other elements that are possibly in the examined water (Gary, 2001). Once the reaction is complete, the amount of arsenic in the sample of tested water can be found using the test strips provided (Gary, 2001). The particular test kit chosen to be exported to Nepal, which includes all the necessary materials to complete this experiment, is approximately \$308 (Cole Parmer, 2016). This amount in Nepalese rupees would be approximately 33,800 rupees (XE, 2016).

Testing for arsenic has been done many times in the US and Atlantic Canada, using a similar test kit (Zheng, 2014). The majority of rural populations depend on private or town well water, which can easily be contaminated with arsenic (Zheng, 2014). However, in the US it is not the government's responsibility to keep track of arsenic testing of the wells; it is the owner's responsibility (Zheng, 2007). Similarly, the farmers of Nepal are mainly subsistence farmers and therefore are responsible for their own land and the quality of the land. The quality of land also includes the quality of the farmer's water (Neupane, 2001).

Arsenic test kit from Cole Parmer Canada



<https://www.linkedin.com/company/cole-parmer>

Cole Parmer Canada is

the company that produces the arsenic test kits (Cole Parmer, 2016). They are located in Montreal, Quebec and were

established in 1955 (Cole

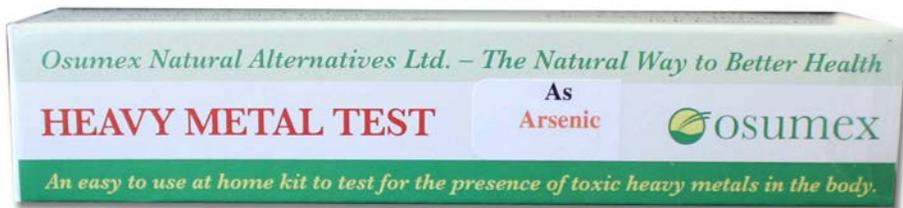
Parmer, 2016). Cole Parmer is well known around the world and is a global source for lab

products and equipment as well as other testing supplies (Cole Parmer, 2016). The company produces their products in Canada. They also get all of the supplies for their products from Canadian companies, but they mainly ship out of the US (Cole Parmer, 2016). There is, however, a solution wherein the product could be shipped out of Canada to the United States and then to Nepal (Cole Parmer, 2016).

Other Canadian Companies

Cole Parmer is only one of many companies that supplies products like arsenic test kits. Hach is a Canadian company located in London, Ontario (Hach, 2016). The company sells water testing kits that act similarly to the arsenic test kit except this kit has the ability to test for other chemicals other than arsenic (Hach, 2016). This would be beneficial if Nepal had a serious problem with chemicals other than arsenic. Another Canadian company that supplies arsenic test kits is Osumex (Osumex, 2016). Osumex has a sales office in Oakville, Ontario. This company is slightly different than others, in the sense that the products sold by Osumex are directed more towards heavy metal elements (Osumex, 2016). Cole Parmer has been chosen as the company to represent this product because the arsenic kit they provide is specifically detecting arsenic,

other
are
water



whereas the
two
companies
just general
test kits.

Benefits to Canada to Export Arsenic Test Kits:

Increases Canadian jobs

Exporting arsenic test kits to Nepal is beneficial to Canada for three reasons. The first reason is that Canada it would increase jobs. Exporting the test kits to Nepal would increase demand for the product, which leads to increased production of the product, therefore creating more jobs (International Trade Administration, 2014). Indirect jobs would also tie into the demand of this product. Cole Parmer sells their products but they do not make the products themselves; they receive materials for their products from other Canadian companies (Cole Parmer, 2016). The exportation of this product would have an impact on Cole Parmer and other companies that are associated with the production of this item.

Helping the Canadian Economy



<http://www.darpanmagazine.com/news/national/canadian-economic-growth-inches-forward-03-in-november-statistics-canada/>

Parmer, 2016). Canada and Nepal already have a strong trade relationship, having 7.1 million dollars' worth of exports from Canada to Nepal and 11.7 million dollars' worth of exports from Nepal to Canada in 2013 (Government of Canada, 2016). Continuing to trade with Nepal would

The exportation of arsenic kits to Nepal would increase the Canadian economy's revenue, and increase profit for the Canadian company's involved in the production. The Canadian companies would have to buy certain parts or sell parts to another Canadian company which would benefit the Canadian economy overall (Cole

strengthen the bond even more and possibly lead to other trade agreements, continuing to benefit Canada's economy.

Trade Agreements

Trading with Nepal could also present opportunities to trade with other nearby countries. Arsenic in groundwater is an important issue for a number of countries similar to Nepal, with farmers who are only able to produce enough for food for their own family (Government of Canada, 2016). If other countries such as India and China see that this product is a success and that it could possibly benefit them, then they might reach out to Canada to form a trade agreement.

Support Available to Export the Product

There are many organizations that provide financial support for companies looking to export globally. Export Development Canada offers programs that would benefit companies looking to export internationally (EDC, n.d). It would be possible for Cole Parmer to receive financial support from their bank if they qualified for EDC support (EDC, n.d). The solutions provided by EDC would assist in lowering the bank's risk and make it easier for them to want to lend the company money (EDC, n.d). There are also a large number of programs offered by the Government of Canada that would help the company financially (Government of Canada, n.d). The CanExport program specifically allows the company to receive a sum of money to reimburse up to half of their expenses so they can promote their business internationally (Government of Canada, n.d).

Process of Export

Before exporting internationally, one has to be aware of the Canadian sanctions, which would prohibit a company from trading with international markets (Canadian Sanctions, 2016).

These sanctions can be found under the United Nations Act (Canadian Sanctions, 2016).

Although trading globally in the past has been quite difficult, having the correct documentation for exporting is now more manageable (McCullough, 1990). There has been a software created, regarding export documentation, that helps to shorten the time, energy and money that is put towards this long process (McCullough, 1990). Cole Parmer is known for exporting globally and they have also been known to use companies such as FedEx and UPS to export their product (Cole Parmer, 2016).

After discussing with one of the FedEx representatives about methods of transportation, the representative provided an estimate cost and route to export the product to Nepal (Fed Ex, 2016). It would cost approximately \$187.42 per box and take about 4 business days for the shipping to be completed (Fed Ex, 2016). The cost is only a representation of shipping one arsenic test kit (Fed Ex, 2016). It is estimated that as a starting experiment, Nepal could use 30 test kits and that would cost approximately \$5,100. There are three main regions in Nepal and the 30 test kits could be spread evenly among the three regions and possibly sold in markets or by vendors. Referring to figure 1, the flow chart depicts the main modes of transportation to export the product from Canada to Nepal.



Figure 1: Representation of the Transportation Path from Montréal to Kathmandu

PART 2: POTENTIAL BENEFITS TO NEPAL



<http://www.infoplease.com/atlas/country/nepal>

Nepal is a country located in South Asia, landlocked between China and India (El-Saharty, Ohno, Sarker, & Secci, 2014).

This country is home to approximately 28 million people and the majority of the economy is agriculture (El-Saharty, Ohno, Sarker, & Secci, 2014).

Even though Nepal is stuck between two larger countries, they still do a great amount of trading with countries such as India and the United States (OEC, n.d). The relationship between Canada and Nepal has been very strong and it is ideal that Canada continues to maintain this status (Government of Canada, 2016). The main objective of this project was to provide an idea for an object that could potentially be exported to Nepal to help the population. This product could be beneficial to either Nepalese farmers or consumers but it was not intended to be a form of competition against the produce already being grown there. A substantial amount of the project evolved around agriculture in Nepal and how to improve the methods being used currently.

Approximately one third of GDP in Nepal is due to agriculture and out of the 28 million people living there, as many as 70% are employed in agriculture (Devkota, 2013). There has been a substantial decrease in agriculture because of the lack of productivity, and irrigating the land all year is only possible for a third of suitable crop land (Devkota, 2013). However, productivity and irrigation are not the only factors that have an impact on Nepal's farming; arsenic is a continuous problem. Farmers in Nepal have dealt with arsenic for many years and

unfortunately this naturally occurring element has an effect on both crops and the people (Devkota, 2013).

Arsenic effects on crop production

There have been multiple studies completed on the effects of arsenic on the production of crops, not just in Nepal. One study focuses on the effects of arsenic on rice crops (Kumar Das, 2007). When zinc and correctly decomposed manure were involved, they had an effect on arsenic levels in the soil, and the rice plants intake of arsenic (Kumar Das, 2007). The results showed that when there was a high concentration of arsenic in the soil, 300mg/kg, the rice plant was more susceptible to dying (Kumar Das, 2007). The problem with arsenic is more importantly the way in which different plants uptake, translocate and bio-magnify arsenic (Chakraborty, 2014). This toxin accesses the plant through its roots, affecting the plants health. (Rosas-Castor, 2014).

Arsenic also has the ability to contaminate groundwater as well as crops (Kumar Das, 2007). Irrigation is the dominant method in agriculture for controlling water in 5% of the mountain region, 26% of the hills region and 69% of the terai region in Nepal is irrigated land (Chakraborty, 2014). However, 60% of irrigation in Nepal is done by groundwater, where majority of arsenic builds up (Chakraborty, 2014).

Arsenic effects on one's health

Globally, there are approximately 261,000 people diagnosed with urinary bladder cancer and about 115,000 deaths each year (Meliker, 2007). Studies have shown evidence that there is a strong relationship between bladder cancer and being exposed to drinking water containing arsenic (Meliker, 2007). In 1980 a study was completed by the Internal Agency for Research on

Cancer (IARC) and they came to the conclusion that inorganic arsenic is considered a carcinogen to humans (Meliker, 2007).

Other studies have drawn a correlation between lung cancer and the inhalation of arsenic. There is also an increase in the risk of skin cancer and being exposed to arsenic, especially through groundwater (Meliker, 2007). Connections have also been made between arsenic in drinking water and diabetes and child mortality rates (Meliker, 2007). The total impact of arsenic compounds all depend on how long one has been in contact with arsenic, how long the arsenic is retained in the body, and the concentration of the element (Shrestha, 2012).



<https://www.theguardian.com/global-development-professionals-network/2016/oct/18/arsenic-contamination-poisoning-bangladesh-solutions>

<http://www.greenmagz.info/arsenic/>

Benefits to Nepal

Quality of Life

The most promising way of removing arsenic to appropriate levels would be through the use of arsenic test kits and filters (Yadav, 2011). Reducing the amount of arsenic in the soil would also reduce the amount of people that are sick (Yadav, 2011). After the earthquake in 2015, 90% of health facilities that were affected by the disaster are non-functional and therefore there is only a limited number of facilities to treat people with arsenic in their body (Khanal,

2015). Majority of the arsenic in Nepal is located in wells, with all of the wells in 2011 containing arsenic (Yadav, 2011). Arsenic is a serious problem in Nepal and peoples' health will not improve if arsenic is not reduced even the slightest (Yadav, 2011).

Knowledge

Testing for arsenic would be beneficial for the farmer, as they would be informed of the chemical itself and how it affects the crops being produced. Arsenic contamination in groundwater irrigation is not documented properly and it is not considered as serious of a problem as it should be (Safapani Project, 2013). The people of Nepal were provided filters by other organizations such as WHO but without the knowledge of the filters, were unable to maintain these filters to their full potential (Safapani Project, 2013).

Crop Yield

One factor that has an impact on crop yield is the amount of arsenic found in the soils of Nepal. A study was done within a greenhouse between two plants (Jiang, 1993). One plant was grown in soil that contained arsenic and the other was in soil that did not contain the toxin (Jiang, 1993). The results of this study showed a strong connection between a decrease in the yield of the crop and the concentration of arsenic (Jiang, 1993).

Reliability of the tests

Some of the people in Nepal may be skeptical about testing for arsenic and questioning whether this technique will work. Arsenic kits have been labeled as simple, very efficient and user-friendly (Deshpande, 2003). These kits can be used for on-site testing of the water contaminated with arsenic, and they are able to test for arsenic concentrations that are as low as 0.01 mg/L, which is a limit set by WHO (Deshpande, 2003). Many countries have used arsenic tests and filters and have had much success (Arora, 2008).

Prevalent Problem in Nepal

Arsenic is a very serious problem in countries such as Nepal, India and Bangladesh (Brammer, 2008). Water that has been polluted by arsenic is used for irrigation of crops and these crops are then sold to consumers, affecting peoples' health (Brammer, 2008). Arsenic is also a potential threat to sustainable agriculture (Brammer, 2008). The more arsenic accumulates in the soil, the more the soil deteriorates and the quality worsens (Finnegan, 2012). Seeing as this is an urgent problem that needs to be attended to, testing for arsenic in certain areas, to understand which areas need the most help, would be a step in the right direction (Brammer, 2008).

Challenges of Exporting to Nepal

Poverty

Approximately 30% of the population receives \$14.00 a month, which is about 959 rupees (IFAD, n.d). Poverty tends to be higher in the rural areas of Nepal instead of the urban areas and this could pose as a challenge since farmers in both rural and urban areas would be the target market (Chhetry, n.d). The farmers of Nepal are mostly subsistence farmers and therefore make very little money off of crops that they may sell (Chhetry, n.d). This would reduce the amount of farmers that can afford the product, depending on the price at which the product is sold.

TABLE 1: *Average annual earnings of employees in Nepal, by broad industry groups: 1964-1965*

S. No.	Industry ¹	Average erngs (Rs. Nepali) ²	Percent to bidi	Percent to all-inds'	Percent to all-inds' except bidi
1	2	3	4	5	6
1.	Rice, Flour & Oil	1,624	27.3	92	101
2.	Bakery	1,220	20	69	76
3.	Sugar Refineries & Crystal Sugar	1,177	20	67	73
4.	Bidi Making	5,954	100	332	...
5.	Yarn & Textiles	1,726	29	98	108
6.	Jute Processing	1,626	27	92	101
7.	Saw Mills & Furniture Making	2,624	44	149	164
8.	Printing Press	1,204	20	68	74
9.	Bricks, Lime kilns & Cement Products	1,329	22	75	83
10.	Repairing Works	1,871	31	106	117
11.	Curio, Jewellery & Metallic Vessels	2,048	34	110	128
12.	Miscellaneous	1,533	26	87	96
	All Industries	1,764	29	100	100
	Range	4,777	80	265	91

Source: *Census of Manufacturing Establishments, 1965*, separate volume for each of the six regions, op. cit., Tables 41 and 42.

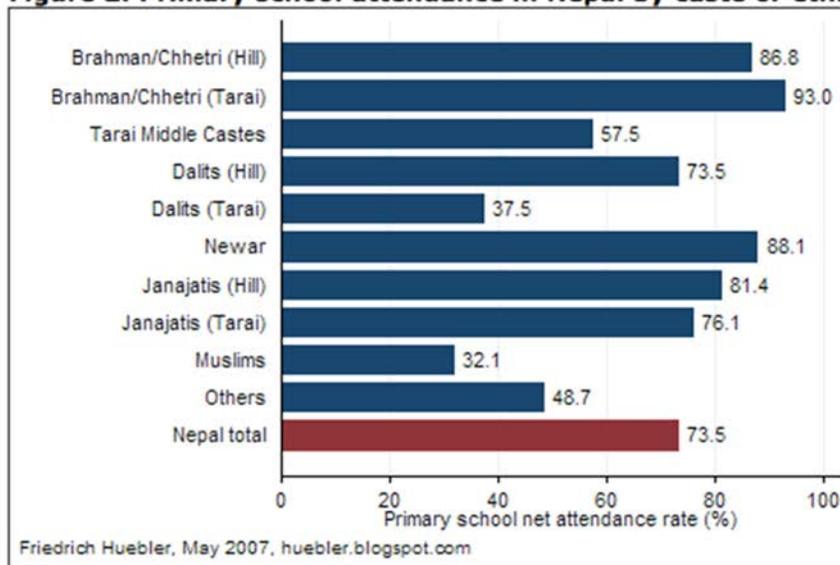
Previous Testing

Arsenic testing has been done many times before in Nepal and this could present another challenge (Yadav, et al., 2014). People may begin to feel defeated by this idea as there is still a great amount of arsenic throughout Nepal as well as nearby countries. However, as time progresses, there is newer and better technology that could provide more results (Snyder, et al., 2016). There has been a breakthrough for water filtration, with the possibility of using a vinegar biosand filter that has been altered to deal with bacteria and other chemicals (Snyder, et al., 2016). This filtration system has the potential to remove both arsenic and nitrate from sections of soil (Snyder, et al., 2016).

Transport

There is the possibility that it may be difficult to transport the product throughout Nepal as there are the three different regions to consider (Donnges, n.d). The roads in Nepal are in poor condition and this could also cause the task of transportation to be rather difficult (Donnges, n.d).

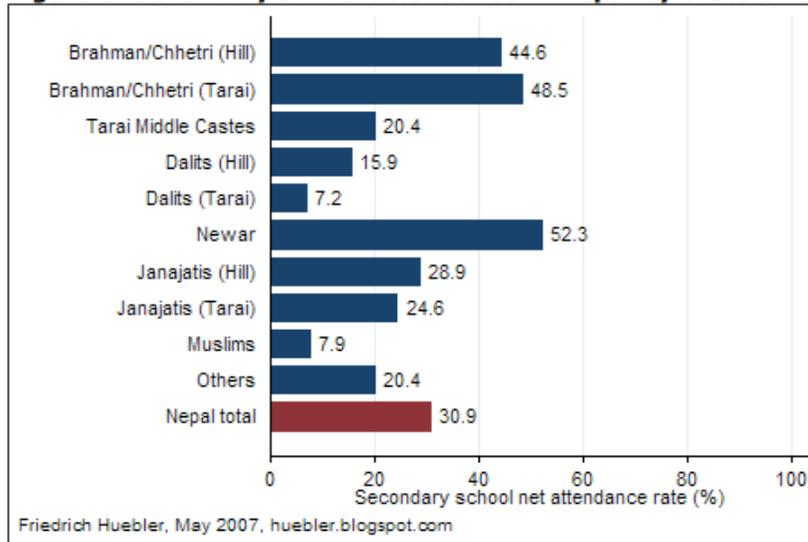
Figure 2: Primary school attendance in Nepal by caste or ethnic group of household head



Source: Nepal 2001 Demographic and Health Survey (DHS).

Lack of Education

Figure 3: Secondary school attendance in Nepal by caste or ethnic group of household head



Source: Nepal 2001 Demographic and Health Survey (DHS).

Although more than half of the population can read in Nepal, many of them still lack knowledge on certain subjects, such as the risks of chemicals like arsenic (Unicef, 2016). Referring to figure 2 and 3, the bar charts show the decrease in the number of children that continue with education after primary school (Figure 2 and Figure 3). Many do not understand the health effects of arsenic or how much of an impact this chemical can have on the production of crops. Unfortunately, the lack of education can be caused by certain barriers such as disabilities, finances, parents' perspective, or just being unaware of the importance of education (Lamichhane, 2012).

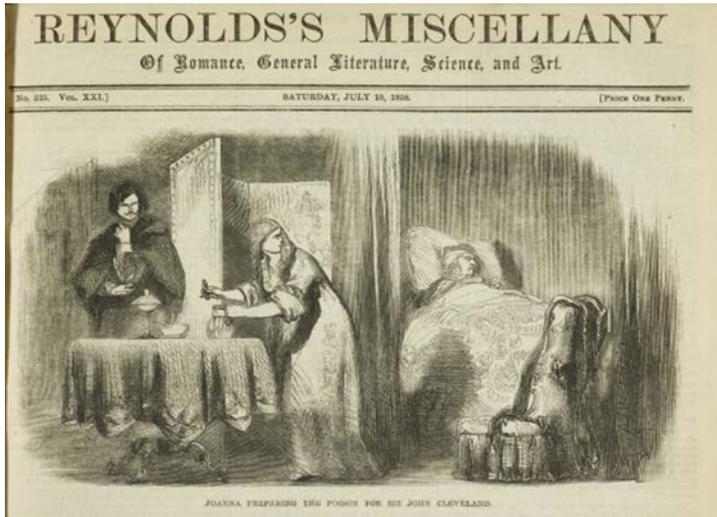
To perform the experiment one would need to be capable of reading and following the instructions. This may be difficult if the instructions are in a different language or if the person is illiterate. Cole Parmer mainly produces the instructions for products in English or French, none of which are the language of Nepal (Cole Parmer, 2016). The language barrier could also pose as another challenge.

Competing Companies

There are competing companies in India and China that sell very similar products and it may be much easier for Nepal to reach out to them for a product. Orbit Technologies is a water test kit producing company in India as well as Palintest which is located in China, the Middle East and Australia (Palintest, 2016). The countries listed are a much shorter distance from Nepal than Canada and that could make the shipping process shorter as well. Were the people of Nepal to know this information, it may sway their decision to invest in a product from Canada.

Time

Since Medieval times, arsenic has been referred to as a very dangerous toxin; even being



used as poison (Bundshuh, et al., 2012). Arsenic has been accumulating in soil for hundreds of years and it would be impossible to be able to get rid of it altogether (Bundshuh, et al., 2012). During 1250 AD arsenic was first isolated as its own chemical and that is when the

controversy began (Mandal, 2002). The solution to this challenge would be to reduce the amount of arsenic to the appropriate level set by WHO so that it won't pose a risk to one's health, and crops (Deshpande, 2003).

Government

Currently, the government only spends about 2.6% of government money on agriculture and agriculture makes up 36% of their GDP (IRIN, 2013). Unfortunately, the government does not understand how serious this problem is and their involvement is key to the solution (IRIN, 2013). Ministry of Agriculture, MOAD, provides services to farmers and one technician has the responsibility of attending to the needs of 1,500 farmers but the ratio of technician to farmers is much smaller in developed countries (IRIN, 2013).

Recommendations

This project could be very successful if the right steps are taken but some recommendations could be set in place. First, the government's involvement would be crucial for the success of this export as well as the purchase of the product by the consumers. The government's presence could possibly influence farmers to purchase this product, especially if the farmers are provided with proof of success from the government. Another recommendation would be to possibly recruit an interpreter or someone who is informed about this product and its benefits to Nepal. This person could relay information to the people of Nepal and convince them to invest in this product.

Conclusion

In conclusion this product would be a very good investment but it would only be a start to a very long project. The seriousness of arsenic and its detrimental effects on the crops and the health of the people in Nepal is of reoccurring importance in this report (Dangic 2007). With the government's involvement and the help of educated volunteers, this product could be of great success in Nepal.

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