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E. Coli: How Can it be Eliminated?

 Is the water that you drink truly purified? How are we to know that our water is free from all harmful bacterium? Bacteria is found everywhere. Some are completely harmless, while others can cause diseases and dangerous illnesses. Even though we do a lot to keep our drinking water clean, some of this bacterium can still seep through many of the filters and processes the water goes through, many of which are E.coli. E.coli is a type of bacterium that can be very dangerous for humans to consume, yet there are many cases where it is found in the water that we drink. Most drinking water comes from local bodies of water, especially in South Dakota. What could be causing the E.coli levels to rise? What are some ways levels of E.coli can be removed from local bodies of water so there is a less chance that it is found in our drinking water? Could it be what is found in our local waters that is causing the problem? There are many things that can cause E. coli to be found in our drinking water; however, considering our drinking water comes from local rivers and lakes, cattle may be the main cause of E.coli.

 Escherichia coli is a flagellated, rod-shaped bacterium that is commonly found in the lower intestines of warm-blooded animals, including humans. It is able to live with or without oxygen, thus once it is released it can be found in soil, sediment, and areas with warm water temperatures. E. coli swim with their flagella in order to control the direction they are migrating to. The  counterclockwise rotation of the flagella gives E. coli an advantage in long-range migration. Howard Berg, a professor of molecular and cellular biology, explains just how much E.coli we are dealing with when he says “A typical stool contains as many as 100 billion bacteria per cubic centimeter. Up to 1 billion of these are E. coli” (2). There are many different types of E. coli. Most cause almost no harm other than brief diarrhea. However, there are some types that we need to watch out for, such as  E. coli O157:H7. “O” meaning the type cell surface and “H” indicating the flagellar antigen. In adults this type of E.coli can cause severe abdominal cramps, vomiting, bloody diarrhea, and in extreme cases kidney failure. However, young children have a higher chance of developing life-threatening diseases when exposed to E. coli O157:H7.

 The U.S environmental protection agency (EPA) has set certain drinking water restrictions and regulations on states under the authority of the 1974 Safe Drinking Water Act. Under these regulations, there are certain levels of contaminants that has to be contained in our drinking water annually. There are contaminants such as inorganic chemicals, which are chemicals such as metals and nitrite that are usually found in water but can end up being an issue if these chemicals are too abundant; organic contaminants, carbon-based compounds that can contaminate the water by discharge from factories or runoff from croplands; and radionuclides which are found either from pollution or just naturally in the water. Lead and copper can be found in our drinking water because of something as simple as household pipes. These elements can cause various health problems, therefore they need to be tested for as well. The Department of Environment and Natural Resources keep annual records of drinking water in South Dakota. They best explain what a public water system is when they say  “A public water system is defined as a water system that provides water via piping or other constructed conveyances for human consumption to at least 15 service connections or serves an average of 25 people for at least 60 days each year.” They also state the three different types of public water systems depending on where you live. There are community, nontransient noncommunity, or transient noncommunity systems. Community systems include towns, housing developments, and rural water systems. Transient noncommunity systems include rest stops, parks or campgrounds, while nontransient noncommunity systems are located in schools, day care centers, and factories.

There are many different types of water treatment processes that can be used in order to keep these contaminants at levels safe enough for humans to consume.  It can either be purified physically, by filtration techniques used to remove solids from liquids, or chemically, by different types of methods depending on the water contamination. Water Treatment Solutions by Lenntech explains that each of these filtrations are “a membrane separation technique in which very fine particles or other suspended matters are separated from a liquid.” The types of filtration in physical purification include microfiltration, which can separate particles that range from 0.1 to 1.5 microns of size such as bacteria; ultrafiltration, which can separate particles that range from 0.005 to 0.1 microns such as proteins and salts; nanofiltration, which can separate particles that range from 0.0001 to 0.005 microns such as viruses, pesticides, and herbicides; and reverse osmosis, which can separate particles up to 0.0001 microns in size, including metal ions. Chemical purification is most commonly used to purify water for public water systems. Disinfection is one of the most important steps in chemical purification because it has the ability to kill unwanted microorganisms. Chemicals such as chlorine and UV rays are used for disinfection. Other chemical purification methods include: distillation, which is the process where water vapor is collected from boiling water; Electrodialysis, which employs an electric current; PH adjustment; and scavenging, which adds a strong-based anion resin in order to kill the organisms that have a slightly negative charge.

In rural areas, many wells are being used for the source of drinking water in households. In fact, according to the Water Quality and Health Counsel, “About 12 million American households, roughly 15 percent of the U.S. population, draw their drinking water from private wells.” Because of all the bacteria found in groundwater, it is very important to to disinfect our private wells. However, the EPA doesn't do this; the owner of the private well is the one responsible to keep it clean and healthy.

I have listed almost all of the processes that our drinking water goes through to keep it clean. However, even with all of these purifications treatments being used, we are still finding E. coli contaminated drinking water. There have been many cases where E. coli has made many people ill because it is found in drinking water. However, who is the culprit in these cases? Is there more regulations to be put on our water systems? The Water Quality and Health Counsel explained one example of a non disinfected well that left over 2000 people ill. This event occurred during the spring of 2000, which was a very rainy and wet year. The non disinfested well was located near a farm, which the fertilizing manure to ran off from, contaminating the well. The well, not being sanitized properly, was found with E.coli in the water. In this case, even though the well wasn't properly disinfected, the farm’s fertilizing manure is what caused the E. coli to appear in the water. Another case of E.coli contaminated drinking water was found in New York City. The New York Times explains that the state’s regulations for water treatment were not fully enforced. In fact, they were hardly enforced at all. The water tanks in the city were found to be heavily contaminated with E. coli. Because of this, they assumed that there had to be some type of animal getting into these water tanks. After the building superintendents inspected the tanks, they found that there were dead birds and mice inside them. There was also findings of a person sleeping between the cover of the tank and the roof.  Health officials made sure of fixing the problem by greater enforcing the laws. In both of these situations, animal feces is what was causing the E.coli contamination. Therefore, suggesting that animals are the main cause of E.coli in our water. If  these animals are found in the water that we get our drinking water from, there is a greater chance that it could be contaminating it with E.coli. Thus, keeping animals out of our local waters as best as we can will help keep our drinking water as clean as possible.

According to the East Dakota Water Development District located in Brookings, SD “Sioux Falls is the only city to use surface water for drinking water (roughly two-thirds of their supply), while the other one-third of their drinking water comes from shallow groundwater which is hydraulically connected to the Big Sioux River. Other cities and rural water facilities along the Big Sioux River also use shallow groundwater wells for a drinking water source. This means that even though you may reside in rural Moody County, if you eat at a restaurant in Sioux Falls, the water used to make ice for your drink was from the Big Sioux River watershed”. Considering the fact that most of our drinking water comes from the Big Sioux River, have you ever imagined what has been in the Big Sioux, or what's living there? South Dakota has many farms that run off into the Big Sioux, cows are even found bathing in certain parts of the Big Sioux, and we drink the water from that river. Yes, it does go through many water processes, but does that make it completely safe? Could contaminants be seeping through these filters? Should we be worried that E.coli is infecting our water, considering all of the manure that is being put into it? Terrance Author can agree to the fact that cows are the culprit when he explains that “Supershedding is a transitory condition that researchers currently think lasts less than a month. Regardless of duration, the basic problem with supershedding is the same: the copious amounts of O157 in the manure don’t necessarily stay where the manure was deposited. Instead, shedding may lead to spreading. An animal that takes a soothing dust bath, for instance, may inadvertently roll over some E. coli-contaminated manure on the feedlot floor and end up with O157 cells stuck to its hide.”  Even the smallest streams can collect runoff from surrounding farms. According to the Department of Environmental and Natural Resources, regulations for animal feeding operations are being held under a water pollution control permit. However should they be regulating the population of cattle in our rivers? Should we be keeping cattle out of our rivers completely? I think putting more regulations on our farms’ cattle will result in a healthy, less-polluted environment, and it will lessen the amount of E. coli contamination dramatically in our drinking water.

In his article “Where Does E. coli Come From? It’s Complicated!” Mark Ibekwe, an Agriculture Research Service Scientist, disagrees with the fact that cattle is the main cause of E.coli when he says “pathogens that end up in local waterways are more often carried there via runoff from urban areas, not from animal production facilities.” Ibekwe believes that the E.coli comes from runoff from residential areas and it is able to stay alive in the water because of the amount of nutrients from manure. He suggested that the levels of E.coli are concerning because of both the amount of human population and animal-feeding operations in the area. I do agree with the fact that animal-feeding operations contribute to the levels of E.coli. However, I do not agree with his suggestion of human population and runoffs from residential areas causing the levels of E.coli to rise. Our farm’s cattle have direct contact with our local waters: releasing feces, bathing, and feeding in our rivers. Human’s feces and wastewater go through sewer lines and wastewater plants which filter it before releasing it into the open rivers and lakes. Humans are also not directly contacting the river water as animals are. This information suggests that animals, mainly cattle, are the main culprit of the amounts of E.coli in our drinking water. Also Ibekwe states that “The bacteria can survive in surface water and sediment because of high nutrient content from manure from livestock facilities.” This statement suggests that there is a great amount of manure in our rivers, and not only can the bacteria survive in it but also comes from it.

As I have said, there are a lot of contributions that have to do with the cause of E. coli to be found in our drinking water; however, considering our drinking water comes from local rivers and lakes, cattle may be the main cause of E.coli. Cattle is the first source that E.coli comes from before entering our rivers and lakes.  They bathe and release many stool into our rivers, especially in the Big Sioux here in South Dakota. Even though there are multiple kinds of treatment water can go through, theres only so much they can do. I suggest, to a solution to this problem, that we put more restrictions on where farmers let their cattle roam. They should not be able to be free roaming in the rivers that we get our drinking water from. This will lessen the amount of cattle bathing in our local rivers, aiming to lower the levels of E.coli in our drinking water.

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