Utilization of Mine Water in Agricultural Activities: A Study

Dr. Rakesh Kumar Pandey[1], Abhishek Kumar Singh[1] and Dr. R. P. Tiwari[2]

[1]Assistant Professor, Amity University Chhattisgarh, Raipur
[2]Professor, Rewa Engineering College Rewa MP

Abstract

Open mining is very common practice in India and around the globe but there is one major issue which comes in open and close mining that is water stored in the mines during rainy season. Normally a mine is dug around 70 feet down and 2 acres in radius which acts a storage unit for water to be stored. The stored water creates a problem for the miner after the rainy season is over the stored water is pumped out later when the miners resume their work. The pumped water is generally pumped out to nearby rivers, ponds, etc. which is harmful for the surrounding and same for the water bodies that they are being dumped in. This water can be treated and can be used for drinking and harvesting the crops. There is only 2.5% is freshwater around the globe with treating the water stored in mines we can solve three problems like water scarcity, better surrounding and help our fellow miners to remove the large amount of water stored in their mines . In Chhattisgarh alone there are more than 50 mines which include active and non-active mines. It shows the amount of water that can be utilized after treatment of mine water. Mine water may be reused for different purpose and should be served as better source of water. This will help to overcome the major problems like scarcity of water, better surrounding and help the miners.

Keywords: Mines, water, Agriculture, Environment

I. Introduction

Water covers 70% of our planet, and it is easy to think that it will always be plentiful. However, freshwater—the stuff we drink, bath in, irrigate our farm fields with—is incredibly rare. Only 3% of the world’s water is fresh water, and two-thirds of that is tucked away in frozen glaciers or otherwise unavailable for our use. As a result, some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. Inadequate sanitation is also a problem for 2.4 billion people—they are exposed to diseases, such as cholera and typhoid fever, and other water-borne illnesses. Two million people, mostly children, die each year from diarrheal diseases alone. Many of the water systems that keep ecosystems thriving and feed a growing human population have become stressed. Rivers, lakes and aquifers are drying up or becoming too polluted to use. More than half the world’s wetlands have disappeared. Agricultural activities consumes more water than any other source and wastage of water is very high because of inefficient use and practices.. Climate change also a measure factor which is altering weather patterns and water around the globe, causing scarcity and droughts in some areas and floods in others. Human body system also depends on water to function properly. Water is necessary to body's temperature regulation, keeping body normal through perspiration. Water flushes out toxins and wastes from body of human being also. Ample water ingestion enables our body to excrete waste through perspiration, urination, and defecation. All known life needs liquid water to function properly. It's essential in part because water is such a good solvent, readily dissolving and transporting nutrients across a wide range of temperatures. It's molecules also play a key role in ensuring proteins behave properly.

Water scarcity in India is due to both natural and human-made causes. The main factors that is contributed to water issues include poor management of resources, lack of government attention, and man-made waste.18 percent of the world's population which resides in India only has access to 4 percent of usable water sources. Official data in the past decade depicts how annual per capita availability of water in the country has plummeted significantly with 163 million Indians lacking access to safe drinking water. The National Institution for Transforming India (NITI Ayog), Government of India has released report 'Composite Water Management Index ' in June 2018 and listed Delhi and other 21 cities in India which would run out of groundwater by 2020. We need to conserve water and come up with a new way to restore the water we have annihilated . By using the water stored in mines which are no use to the owner , can be treated and can be used again for drinking , washing , growing crops , etc. There are a lot mines present in the world which accumulates water over the rainy season. Then the water stored in the mines are pumped out in the surroundings which effects the nearby crops, lands, etc. Thus this water can be treated with some methods to purify it and to be used again. This water will help in increasing the water resources and replenish the ones we have annihilated.

II. Methods of Treating Mines Water

Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Most water is purified and disinfected for human consumption (drinking water), but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination; and the use of electromagnetic radiation such as ultraviolet light. Water purification may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, and fungi as well as reduce the concentration of a range of dissolved and particulate matter.

2.1 pH adjustment: Pure water has a pH close to 7 (neither alkaline nor acidic). Sea water can have pH values that range from 7.5 to 8.4 (moderately alkaline). Fresh water can have widely ranging pH values depending on the geology of the drainage basin or aquifer and the influence of contaminant inputs (acid rain). If the water is acidic (lower than 7), lime, soda ash, or sodium hydroxide can be added to raise the pH during water purification processes. Lime addition increases the calcium ion concentration, thus raising the water hardness. For highly acidic waters, forced draft degasifies can be an effective way to raise the pH, by stripping dissolved carbon dioxide from the water.

Making the water alkaline helps coagulation and flocculation processes work effectively and also helps to minimize the risk of lead being dissolved from lead pipes and from lead solder in pipe fittings. Sufficient alkalinity also reduces the corrosiveness of water to iron pipes. Acid (carbonic acid, hydrochloric acid or sulfuric acid) may be added to alkaline waters in some circumstances to lower the pH. Alkaline water (above pH 7.0) does not necessarily mean that lead or copper from the plumbing system will not be dissolved into the water. The ability of water to precipitate calcium carbonate to protect metal surfaces and reduce the likelihood of toxic metals being dissolved in water is a function of pH, mineral content, temperature, alkalinity and calcium concentration.

2.2 Sedimentation: Waters exiting the flocculation basin may enter the sedimentation basin, also called a clarifier or settling basin. It is a large tank with low water velocities, allowing floc to settle to the bottom. The sedimentation basin is located close to the flocculation basin so the transportation between these two processes does not permit settlement or floc break up. Sedimentation basins may be rectangular, where water flows from end to end or circular where flow is from the centre outward. Sedimentation basin outflow is typically over a weir so only a thin top layer of water—that furthest from the sludge—exits. In 1904, Allen Hazen showed that the efficiency of a sedimentation process was a function of the particle settling velocity, the flow through the tank and the surface area of tank. Sedimentation tanks are typically designed within a range of overflow rates of 0.5 to 1.0 gallons per minute per square foot (or 1.25 to 2.5 liters per square meter per hour). In general, sedimentation basin efficiency is not a function of detention time or depth of the basin. Although, basin depth must be sufficient so that water currents do not disturb the sludge and settled particle interactions are promoted. As particle concentrations in the settled water increase near the sludge surface on the bottom of the tank, settling velocities can increase due to collisions and agglomeration of particles. Typical detention times for sedimentation vary from 1.5 to 4 hours and basin depths vary from 10 to 15 feet (3 to 4.5 meters).Inclined flat plates or tubes can be added to traditional sedimentation basins to improve particle removal performance. Inclined plates and tubes drastically increase the surface area available for particles to be removed in concert with Hazen's original theory. The amount of ground surface area occupied by a sedimentation basin with inclined plates or tubes can be far smaller than a conventional sedimentation basin.

2.3 Sludge storage and removal: As particles settle to the bottom of a sedimentation basin, a layer of sludge is formed on the floor of the tank which must be removed and treated. The amount of sludge generated is significant, often 3 to 5 percent of the total volume of water to be treated. The cost of treating and disposing of the sludge can impact the operating cost of a water treatment plant. The sedimentation basin may be equipped with mechanical cleaning devices that continually clean its bottom, or the basin can be periodically taken out of service and cleaned manually.

2.4 Floc blanket clarifiers: A subcategory of sedimentation is the removal of particulates by entrapment in a layer of suspended floc as the water is forced upward. The major advantage of floc blanket clarifiers is that they occupy a smaller path than conventional sedimentation.

Disadvantages are that particle removal efficiency can be highly variable depending on changes in influent water quality and influent water flow rate.

III. Discussion

There are a lot of mines present in the world which accumulate water over the rainy season. Then the water stored in the mines are pumped out in the surrounding areas which effects the nearby crops, land etc. The water can be treated with some methods to purify and which can be further used. This water will help in increasing the water resources.

In Chhattisgarh alone there are more than 50 mines which include active and non active mines. It shows the amount of water that can be utilized after treatment of mine water. Mine water may be reused for different purpose and should be served as better source of water for agricultural activities. This will help to overcome the major problem like scarcity of water for agricultural activities, better surrounding and help the miners also.

The water accumulated over the surface of mines can be considered as less contaminated and can be purified with simple water purification techniques, therefore it can be cost effective approach for the treatment of water for various purposes.

The following are the various application of mines water:-

- It can be used for drinking purposes after suitable treatment.
- It can be used for irrigation in agriculture.
- Mines can also be used in different rural areas for the purpose of Rain water harvesting.

IV. CONCLUTION

As per above discussion we can conclude that mine water may be utilized in various activities as well as for agricultural activities. Utilization of mine water also eliminates the scarcity of water in concerned area of mine. Thus despite of fresh water resources we can integrate all possible measures to ensure sustainable use of water resources like recycle, reuse and improving the effective use of water.

References

[1]. A. J Gunson, B Klein, M Veiga and S Dunbar (2012), Reducing Mine water requirements, Journal of Cleaner Production, 21(1) 71-82

[2]. Omar Rimawi, Anwar Jies (2009) Reuse of mining wastewater in agricultural activities in Jordan, Environment Development and Sustainability 11(4):695-703

[3]. Abreu, M. M., Matias, M. J., Clara, M., Magalha˜es, F., & Basto, M. J. (2007). Impacts on water, soil and plants from the abandoned Miguel Vacas copper mine, Portugal. Journal of Geochemical Exploration