Bioremediation Technique for Polluted Soil of Sugar Industry

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Abstract: As increases in population and industrial economies, there is corresponding increase in environmental pollution. Industrial pollution has been continues to major factor causing the degradation of the environment around us, affecting the water we bodies, the air that we use for our living activities and the soil we produce our food. The rapid increase in industrialization is consuming large areas of agriculture lands, along with serious environmental degradation as well as to soil. Water originating from various industries is used by farmer for agriculture. Because of this wastewater land gets polluted and fertility of soil reduces. In rural areas some sugar industries are distributing their waste water on the open land. Waste water gets percolated in soil and get mix with ground water also. This made soil polluted. Sugar industries work for around 6 months in a year. And waste water contains high pH value, high salt concentration; other contents. This pollution reduces crop yield capacity of soil. To reduce this pollution the technique includes addition of some seeds like Moringa oleifera, Acacia nilotica, Tamarindus indicus, cowdung in that polluted soil. That seeds were allowed to grow in the pots for 60 days. The soil is tested before addition of seeds and after completion of 60 days. Soil shows changes in pH, conductivity and N, P, K contents. Among all these pot with cowdung and pot with Moringa oleifera shows more effective results.

1. Introduction

Soil is one of the most important natural resources. In recent years, much of the land has become polluted by sewage, industrial wastes and chemicals produced by industry. During the production, industries generate useless by products and waste materials with large percentage of the harmful chemicals. Soil is a living matrix that is an essential part of the ecosystem. It is a most important resource for agricultural production and food security, also towards maintenance of most life process. The effluent generated from various industries like chemical, sugar mill, textile, dairy, tannery industries are the major cause of soil pollution. These industries produce large amount of waste water as effluent. All types of effluents and many by products from any kind of industry create most harmful pollution to the water bodies and soil properties. Some time effluents containing various metallic and non-metallic elements which act as nutrients, but if they are present in higher concentration it show toxic effects on seed germination and seedling growth, this is going to affect plant growth and yield in cultivated land. Most of the sugar mills are discharging their effluent to the environment without any treatment. Sugar industry effluent constitute number of harmful chemical elements like suspended and dissolved solids, high pH, high salt concentration, chlorides, sulphate, nitrates, calcium and magnesium. Bioremediation is the use of biological agents such as bacteria, fungi and plants to remove or overcome the pollutants from the polluted soil. For the treatment of these polluted soil plant species which is available in large amount.

It is necessary to conduct experiments on these polluted soils on agricultural crops before they are used for crop cultivation. Tree species play a major role in reduction of pollutants. Growing of tree seedlings is one of the most effective techniques for the removal of pollutants. The toxic compounds are trapped into the trunks of such tree species which will remain for a longer time and will not come to the food chain as well. It is an cost effective technology that is most useful when the contaminates are with the root zone of plants. Bioremediation is the use of living organisms to reduce or remediate polluted soils, is an emerging technology.

2. Methodology

Sampling: Sample is taken from land situated near sugar factory which is in rural area. That means, soil was collected from such farm where waste water was deposited year by year.

Material: Moringa oleifera, Acacia nilotica, Tamarindus indicus, cowdung, Earthen pots.
Procedure:

By Seeds:
- Firstly after collection of sample pots were arranged. Initial parameters of soil were determined.
- These pots were filled with 5 kg of sugar mill effluent polluted soil.
- The seeds of tree species were sown in pots separately and also in combination, each tree species grown in separate pots to know the efficiency of the species in removing pollutants.
- All species were allowed to grow in polluted soil up to 60 days. The soil samples were collected from the pot after 60 days and they were analyzed to know their properties mentioned in table.

By Cow dung:
- These pots were filled with 5 kg of sugar mill effluent polluted soil.
- In that pot or sample some amount of cow dung are properly mixed.
- The soil samples were collected from the pot after 60 days and they were analysed to know their properties.

Tests:
- 1. pH.
- 2. Conductivity.

2. RESULT

After the treatment of soil by plant species for 60 days this soil shows very large variation as compare to original polluted sample. In polluted soil pollutants were present in large amount and after using bioremediation technique it shows changes that means reduction in pollutants. Soil polluted by sugar effluent can be treated by growing small trees. These trees absorb these pollutants from soil to certain limits. As given in below table polluted soil contain large amount of pollutants and this soil is very harmful to crop production. So by using tree species like Moringa oleifa, Acacia nilotica, Tamarindus indicus and amendment like cow dung it can be treated without damaging any other properties of soil. As mention in table Moringa Olefera shows very good effect than other species and also this plant shows more growth among all plant. Cow dung is highly effective than seeds.

As Potassium increases crop yields because it increases root growth and improves drought tolerance along with large increases in protein content of plants.
Potassium is a highly mobile element in the plant and is translocates from the older to younger tissue. Consequently, potassium deficiency symptoms usually occur first on the lower leaves of the plant, and then transfer to the top. It affects plant growth. So it should be in appropriate range. But in our case soil has very large potassium already. It may be because of highly pollution and more use of fertilizer by peasant. Phosphorus is a component of the complex nucleic acid structure of plants, which regulates protein synthesis. Phosphorus is important in cell division and development of new tissue that means for the development of plant. Phosphorus is also associated with complex energy transformations in the plant. A phosphorus deficiency is similar to nitrogen deficiency when plant starts to growth. Yellow colour of plant may be phosphorus deficient.
So finally it is observed that these properties of soil should be in appropriate extent to smooth growing of plants.

Results are shown in table below:

<table>
<thead>
<tr>
<th>Sr.NO</th>
<th>Name of substance</th>
<th>pH</th>
<th>EC (Mhos)</th>
<th>C (kg/ha)</th>
<th>P (kg/ha)</th>
<th>K (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polluted Soil</td>
<td>5.41</td>
<td>9.51</td>
<td>4.59</td>
<td>10.57</td>
<td>5373.74</td>
</tr>
<tr>
<td>2</td>
<td>All tree (mix)</td>
<td>7.40</td>
<td>4.03</td>
<td>2.49</td>
<td>08.11</td>
<td>3536.02</td>
</tr>
<tr>
<td>3</td>
<td>Moringa olefera</td>
<td>7.03</td>
<td>2.07</td>
<td>2.22</td>
<td>12.06</td>
<td>4784.40</td>
</tr>
<tr>
<td>4</td>
<td>Tamarindus indicus</td>
<td>7.42</td>
<td>5.03</td>
<td>2.43</td>
<td>12.72</td>
<td>4990.36</td>
</tr>
<tr>
<td>5</td>
<td>Acacia nilotica</td>
<td>7.32</td>
<td>4.94</td>
<td>5.07</td>
<td>11.40</td>
<td>4578.45</td>
</tr>
<tr>
<td>6</td>
<td>Cow-Dung</td>
<td>7.51</td>
<td>1.91</td>
<td>2.13</td>
<td>12.01</td>
<td>4123.02</td>
</tr>
</tbody>
</table>

3. Conclusion

By growing Moringa oleifera, Acacia nilotica, Tamarindus indicus plants in polluted soil upto 2 months it shows reduction in pollutants. Moringa Olefera shows very good effect than other plants. Cow dung is more effective than all other material.

4. References


