JKLI

Jurnal Kesehatan Lingkungan Indonesia
23 (3), 2024, 279 – 286
DOI : 10.14710/ jkli.23.3.279-286
Available at https://ejournal.undip.ac.id/index.php/jkli

The Analysis of the Impact of Petroleum Mining on the Environment and Community Economy in Wonocolo Village of Bojonegoro Regency

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Info Artikel:Diterima 9 Januari 2024 ; Direvisi 27 Mei 2024 ; Disetujui 16 Juli 2024
Tersedia online : 26 Agustus 2024 ; Diterbitkan secara teratur : Oktober 2024

Cara sitasi: Andriyan R, Astutik S, Wijayanto Y, Kurnianto FA, Pangastuti EI. The Analysis of the Impact of Petroleum Mining on the Environment and Community Economy in Wonocolo Village of Bojonegoro Regency. Jurnal Kesehatan Lingkungan Indonesia [Online]. 2024 Aug;23(3):279-286. https://doi.org/10.14710/jkli.23.3.279-286.

ABSTRACT

Latar belakang: Pertambangan minyak bumi tradisional menyebabkan kerusakan lingkungan terutama pada tanah. Proses pengolahan minyak bumi menggunakan alat sederhana menyebabkan minyak mentah tumpah ke permukaan tanah yang dapat merubah sifat-sifat tanah. Pertambangan minyak bumi tradisional juga dapat meningkatkan pendapatan ekonomi masyarakat lokal karena dikelola langsung oleh masyarakat. Tujuan penelitian ini adalah untuk mengetahui perubahan sifat fisika dan kimia tanah tercemar limbah minyak bumi serta perbandingan pendapatan masyarakat dari hasil penambangan minyak pada tahun 2010 dengan 2023.
Metode: Metode penelitian kualitatif digunakan untuk menjawab tujuan penelitian. Analisis deskriptif melalui survey lapangan digunakan untuk menggambarkan kondisi tanah secara fisika dan kimia serta kondisi perekonimian masyarakat lokal yang dilakukan pada tahun 2023. Parameter kualitas tanah yang diperiksa antara lain struktur tanah, konsistensi tanah, tekstur tanah, warna tanah, dan pH tanah yang dilakukan pada 7 titik berbeda dimana sampel titik 4 merupakan sampel tanah tidak tercemar limbah minyak bumi. Perbandingan pendapaan masyarakat deperoleh melalui wawancara terhadap 7 pekerja tambang yang secara khusus mewakili populasi yang diinginkan
Hasil: Hasil menunjukkan hilangnya konsistensi pada permukaan tanah, tekstur tanah didominasi pasir, warna tanah menjadi hitam pekat, dan pH tanah berubah. Limbah minyak bumi tidak dapat merubah struktur tanah secara partikel, akan tetapi limbah minyak dapat menyelimuti partikel-partikal tanah karena minyak bumi memiliki efek pelumasan. Hasil pendapatan dari pertambangan minyak bumi mengalami penurunan dan tidak lagi dapat memenuhi kebutuhan masyarakat lokal.
Simpulan: Limbah minyak bumi dapat merubah sifat fisik dan kimia pada tanah serta meracuninya sehingga merusak ekosistem tanah, sedangkan hasil pertambangan minyak bumi mengalami penurunan akibat jumlah minyak yang akan habis.

Kata kunci: Pertambangan; Lingkungan; Ekonomi; Minyak Bumi

ABSTRACT

Background:*Traditional petroleum mining causes environmental damage, especially to the soil. The crude oil extraction process using simple tolls results in crude oil spilling onto the soil serface, which can alter soil properties. Traditional petroleum mining can also increase the economic income of local communities because it is managed directly by the community. The aim of this research is to determine changes in the physical and chemical properties of soil contaminated with petroleum waste as well as a comparison of community income from oil mining in 2010 and 2023.*

Method: *The qualitative research method is used to answer the research objectives. Descriptive analysis through field surveys is used to describe the physical and chemical conditions of the soil as well as the economic conditions of local communities which will be carried out in 2023. The soil quality parameters examined in clude soil structure, soil consistency, soil texture, soil color, and soil pH, conducted at 7 different points, where sampel point 4 represents uncontaminated soil samples from oil waste.* The comparison of community income was obtained through interviews with 7 mine worker who specifically represent the desire population.

Result:*The results indicate a loss of consistency on the soil surface, with soil texture dominated by sand, soil color becoming dark black, and a change in soil pH. Petroleum waste cannot change the soil structure in terms of particles, but oil waste can cover soil particles because petroleum has a lubricating effect. Income from petroleum mining has decreased and is no longer able to meet the needs of local communities*

Conclusion:*Petroleum waste can change the physical and chemical properties of soil and poison it, thereby damaging the soil ecosystem, in contrast, the results of oil mining are declining due to the decreasing amount of oil reserves.*

Keywords: Mining; Environment; Economy; Petroleum

INTRODUCTION

Petroleum is a natural resource that is used in industrial processes, household needs,transportation activities, and is a source of exports as the country's foreign exchange reserves. Petroleum mining is very necessary to open up employment opportunities and increase economic income in a stable manner as well as being able to improve community welfare. Traditional petroleum mining that extracts oil using simple tools has a direct risk of environmental damage caused by oil spilling onto the ground surface (1). Oil spills cause serious pollution to the surrounding environment which results in disruption of the ecosystem around traditional oil mining wells.

The process of exploiting petroleum can produce hazardous and toxic waste which is classified as B3 (2). Spilled waste can become a pollutant that damages the environment in the area because hydrocarbon compounds are poisonous and contain carcinogens so that soil contaminated with hydrocarbon residue endangers life and can kill living creatures in the area (3). Petroleum mining processing is carried out conventionally, the process of extracting and separating crude oil from produced water is only carried out with the help of simple tools so that the possibility of crude oil will spill in large quantities (4).

The process of separating water from imperfect oil and then disposing it into the ground or water bodies can pollute the environment because it still has a pollution value higher than the required quality standards. Soil pollution due to oil extraction can affect vegetation and population of arthropods which can disrupt the soil ecosystem because the nature of hydrocarbons can kill various plants and microorganisms in the soil. Hydrocarbon compounds are recalcitrant, making them difficult to degrade both in water and on land (5) The content of hydrocarbon compounds in crude oil is around 50-98% and the remainder is non-hydrocarbon compounds.

Apart from that, crude oil also contains a lot of certain metals, high concentrations of metals can be harmful to the environment such as soil, water, animals and plants, disrupt the fragile ecological balance and can even contaminate food sources (6). Soil is an important factor in supporting life for animals, plants and humans. Oil spills will change the properties of the soil, especially the physical and chemical properties of the soil because the hydrocarbon compounds in petroleum damage the soil structure so that the soil experiences changes in its physical and chemical properties and can poison the soil ecosystem (7).

Petroleum spills can cause changes to the physical and chemical properties of soil, including structure, consistency, texture, color and pH of the soil and affect soil fertility levels. The physical properties of soil are related to fertility and influence plant growth and as a place for organisms to live. The physical properties of soil can determine whether land and environmental conditions are good or not, play an important role in the availability of ground water, regulate air in the soil, and influence plant growth and development (8). Damage to the physical properties of the soil can affect the growth of plant roots to obtain water and nutrients.

The problem of land pollution is related to the problem of water and air pollution, because the source of water and air pollution comes from soil pollution (9). Soil conditions contaminated by petroleum in the Wonocolo Village oil mines are often found around petroleum drilling wells. The soil condition has a high hydrocarbon content, exceeding the standard quality limit, with the oil wastecontaminated soil sample show a level of 6.05% (10). The impact of soil pollution due to petroleum can be felt by microorganisms and humans when they come into contact with or accidentally consume water sources or food sources that have been contaminated.

The number of oil wells in Wonocolo village is currently around 700, which have been drilled by the community, but only about 150 wells are active, and the rest are left without further reclamation (11). Traditional petroleum mining in Wonocolo village, Kedewan District, Bojonegoro Regency is part of the Cepu Block mining site as the first oil drilling site for the Dutch in 1893 (12).Located approximately 22 km to the northeast of Cepu District, Central Java, located at an altitude of 170 m above sea level (13). Traditional petroleum mining, which has been carried out since the colonial era, has had an impact that can be felt by the community (14).

The activity of extracting oil from the earth which is carried out by drilling the ground at a certain depth to reach the oil source can have two very influential impacts on human life, these two impacts are negative impacts and positive impacts (15). Apart from having an impact on the environment, conventional petroleum mining also has an impact on the economic conditions of the community. The presence of mining has a positive impact on employment in the mining sector and local trade which provides jobs from inside and outside the village and increases the income of the population (16).

The increasing number of oil wells has caused widespread soil contamination and rapid depletion of petroleum, forcing miners to change professions. This study aims to determine the changes in the physical and chemical properties of soil based on soil structure, soil consistency, soil texture, soil color, and soil pH tested on natural soil and oil-contaminated soil to understad the level of soil quality degradation and its impact on surrounding vegetation, as well as to ascertain the comparison of community income from oi mining in 2010, when people who mined manually began swithching to diesel power, making the procoss easier and yielding more oil, with 2023 when the research ws condocted.

MATERIALS AND METHODS

This study uses the method descriptive with a qualitative approach. This approach is used to describe in more detail the changes in soil properties due to contamination by petroleum waste. Apart from that, this research also analyzes the results of community income from petroleum mining. The sampling method and determination of sampling points uses purposive sampling. The parameters observed are physical parameters on soil conditions and economic parameters on mine workers' income. There are 7 sample points taken: 2 sample points from active oil wells, 2 sample points from former mining wells, 2 sample points from the refinery, and 1 sample points from the fields around the mining area

The intact soil samples is taken using a 5 cm diameter iron pipe to a depth of 20 cm for further observation. The soil sample parameters observed included soil structure, soil consistency, soil texture, soil color, and soil pH. Samples were analyzed by means of field tests on soil physical properties and laboratory tests on soil pH. Techniques for analyzing the physical properties of soil in the field are carried out in different ways for each parameter. The soil structure testing is conducted using a Loop as a tool for visual observation to determine the shape, size and stability of the soil structure which exhibits signs such as clumps, fragments, or visible layers.

Soil consistency testing is conducted using the finger method by shaping it into a small ball, then pressing, squeezing, kneading, and forming long rolls, which are further analyzed to determine the level of stickiness, plasticity and soil resistance to pressure under dry, moist, and wet conditions. Soil texture testing is performed using the touch method and mud test by pressing and kneading between fingers to determine the smoothness or coarseness of the soil sample and forming ribbon rolls, which are then analyzed based on the soil texture triangle. If the soil can be formed into ribbons and does not easily crumble, it has a high clay content.

Soil color testing is carried out by comparing the soil color with the Munsell soil color chart, including the basic color of the soil in the field and the color of soil contaminated with oil waste at each depth. Soil pH testing is carried out by laboratory testing to determine the degree of soil acidity (pH) using a pH stick and chemical solutions carried out at the Jember University Geography Study Laboratory. The testing is done using solutions of 10% KCL, 10% Aquades, and 1% H2O2 poured onto the soil sample. The next step is to dip the pH stick and and analyze its acidity level.

The economic parameters analyzed are the mining worker's education level, income level, and level of wealth owned. The economic parameters were obtained through interviews with 7 respondents who work as petroleum miners. The selected respondents are considered capable of providing comprehensive information regarding the questions given to obtain the required data. The interviews are used to analyze income results in 2010 and 2023 in order to obtain data on the increase or decrease in community income from oil mining. The resource persons are people who work as oil miners and live in Wonocolo Village, Kedewan District.

RESULTS AND DISCUSSION

1. Physical and Chemical Properties of Soil

The quality of the physical properties of the soil from 7 samples was divided into 2 parts at each depth, namely 1-10 cm and 11-20 cm. Based on the FAO map, the soil in Wonocolo Village is a type of vertisol soil which has a vertical/changing nature due to high clay and clay content of more than 30% in all soil horizons with montmorillonite as the most dominant clay mineral (17). The quality of soil contaminated with petroleum waste at the research location shows changes in the physical properties of the soil. Sample point 4 is a soil sample not contaminated with waste (normal). Changes in the physical properties of the soil can be observed in the following table.

Table 1 Soil Structure According to Depth

Sample	Depth 1-10cm	Depth 11-20cm
1	Granular	Rounded lumps
2	Granular	Rounded lumps
3	Granular	Granular
4	Granular	Rounded lumps
5	Granular	Granular
6	Granular	Rounded lumps
7	Granular	Rounded lumps

Table 2 Soil Consistency According to Depth

	Soil consistency 1-10 cm deep			Soil consistency depth 11-20 cm		
Samples	**Dry**	**Moist**	**Wet**	**Dry**	**Moist**	**Wet**
1	Soft	Very loose	Not sticky	A bit loud	Loose	Sticky
2	A bit loud	Very loose	A bit sticky	A bit loud	Loose	A bit sticky
3	Let go	Let go	Not sticky	A bit loud	Loose	Sticky
4	Very hard	Very determined	Very sticky	Very hard	Very determined	Very sticky
5	Hard	Firm	Very sticky	Very hard	Very determined	Very sticky
6	Let go	Let go	Not sticky	Hard	Loose	A bit sticky
7	Soft	Very loose	A bit sticky	A bit loud	Loose	A bit sticky

Table 3 Proportion of Soil Texture

Sample Point	Proportion (%) Soil samples 1-10 cm			Texture Class	Proportion (%) Soil samples 11-20 cm			Texture Class
	Sand	**Dust**	**Look**		**Sand**	**Dust**	**Look**	
1	60%	40%	20%	*Sandy loam*	40%	50%	20%	Silty loam
2	60%	40%	20%	*Sandy loam*	20%	40%	60%	Silty clay
3	40%	50%	20%	*Silty loam*	40%	50%	20%	Silty loam
4	40%	50%	20%	*Silty loam*	20%	40%	60%	Silty clay
5	40%	50%	20%	*Silty loam*	20%	40%	60%	Silty clay
6	60%	40%	20%	*Sandy loam*	40%	50%	20%	Silty loam
7	60%	40%	20%	*Sandy loam*	20%	40%	60%	Silty clay

Table 4 Soil color

	Soil color depth 1-10 cm		Soil color depth 11-20 cm	
Point	**Munsell**	**Color**	Munsell	Color
1	10 YR 5/4	Yellowish brown	10 YR 5/6	Yellowish brown
2	10 YR 3/3	Dark brown	10 YR 5/2	Graying brown
3	10 YR4/1	Dark grey	10 YR 5/2	Graying brown
4	10 YR 7/6	Yellow	10 YR 7/6	Yellow
5	10 YR 5/6	Yellowis brown	10 YR 5/6	Yellowis brown
6	10YR 2/1	Black	10YR 3/1	Dark grayish brown
7	10YR 2/1	Black	10YR 4/2	Dark grayish brown

Table 5 Soil pH depth 1-20

Sample Point	pH	Soil properties	pH level
1	8	Slightly alkaline	Very high
2	5	Sour	Low
3	8	Slightly alkaline	Very high
4	7	Neutral	Tall
5	6	A bit sour	Currently
6	8	Slightly alkaline	Very high
7	8	Slightly alkaline	Very high

Based on Table 1, the research results indicate that the structure of soil contaminated with oil waste did not experience any physical changes. Soil samples at a depth of 1-10 cm experienced heavy damage due to oil waste, while samples at a depth of 11-20 cm experienced light soil damage. This condition occurs because vertisol soil has a micro pore size which can inhibit the rate of oil waste towards the unsaturated zone. Waste oil stuck on the surface of the soil causes surface soil contaminated with waste to become damaged. Soil damage due to oil waste causes changes in the physical and chemical properties of the soil which results in the death of soil organisms and plants that live around it.

The soil in oil mining areas has a granilar or grainy structure at a depth of 1-10 cm while the soil structure at a depth of 11-20 cm is dominated by a rounded lumpy structure with a size of <0.002 mm so that the soil grains are fine. The spillage of waste oil onto the surface of the soil causes the stickiness of each grain of soil to be lost. This condition has the impact of clogging the soil pores and causing animals in the soil to die. The structure of soil particles does not show any influence from petroleum waste, but oil waste affects soil stickiness. Oil waste also damages aggregate levels and organic content in the soil.

In traditional oil mining using simple tools, the process of extracting oil from the weel will also bring mud and heavy metals along with water to the surfaca of the soil, thus altering the soil composition, while the oil sludge will enter the soil pores and cover them. The incoming waste oil does not affect the shape of the soil particles, but petroleum waste will coat individual particles and groups of clay soil, reducig the adhesive properties of each soil particle. This process can form lumps that are similar to silt-sized particles or even sand (18).

Based on Table 2, the research results indicate that the soil consistency based on the level of water content show that the soil experiences changes in the level of stickiness of each grain of soil. Soil samples contaminated with waste at a depth of 1-10 cm contain more oil waste so that the soil's adhesion is reduced. Waste oil that enters the soil affects the level of hardness and stickiness of the soil and makes each soil particle easily separate from each other if it receives a certain pressure. Waste oil contamination reduces the maximum dry density, optimum water content, soil strength to withstand pressure, shear strength, the level of plasticity in clay decreases, and the clay becomes slender.

Changes in the level of strength and adhesion to the soil are caused by waste oil which has coated the soil grains because oil has a lubricating effect thereby reducing the friction force between soil particles. This condition causes the adhesion and cohesion forces on soil particles to decrease so that the soil grains that form lumps can be destroyed easily. In addition, oil contamination of the soil has reduced the ability to absorb water and can dissipate the applied energy, causing low soil compaction levels (18). In its natural statte, vertisol soil has fie grain size and high clay content , causing it to harden when dry and become clumbly when moist.

Based on Table 3, the research results indicate that the soil texture in the field show that soil samples dominated by sand fractions were found to be more abundant in soil contaminated with petroleum waste on surface soil, this was due to mud being lifted from the well when the oil was lifted smoothly. human activities that change the proportion of soil fractions. The soil at the research location is dominated by a clay texture with moderate water absorption capacity.Vertisol soil has a particle size of <0.002 microns with small interstitial spaces so that it can prevent hydrocarbon pollutants from flowing into the unsaturated zone and retain them on the soil surface.

The particle size and properties of vertisol soil make the rate of hydrocarbon biodegradation very slow (19). Even though waste oil cannot enter the unsaturated zone, waste oil that settles on the surface can destroy the properties of the soil on the surface. In fine-grained soils, hydrocarbons can cause changes in grain texture, grain size, shape and porosity thereby reducing the number of micropores and overall surface area. Physical interactions between particles are dominant in fine-textured soil types, causing characteristics such as texture, porosity, wax properties and cohesion to be most affected by hydrocarbons (20).

Wonocolo Village has vertisol soil with a clay texture with a high clay content so that the deeper the soil, the smoother it will be, while the upper part will be dominated by the sand fraction and has a micro pore size which can prevent oil waste from entering deeper into the soil, this can be seen in Figure 1.

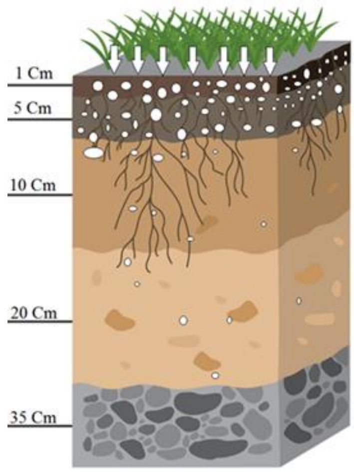

Figure 1. Distribution of waste oil contamination in the soil

Based on Figure 1, it shows that the deeper the soil, the smoother it will be because the soil texture is dominated by the clay fraction which has a relatively small grain size, while Figure 2 shows that vertisol soil with a micro pore size can hold petroleum waste on the soil surface. The results of measuring the area of distribution of oil waste carried out in oil wells and refining areas, soil contaminated with waste in oil wells which have been abandoned for around 40 years, there are still waste deposits 0.1-0.5 mm thick on the surface of the soil, this is based on the results of area measurements distribution of waste oil carried out in oil wells and refining areas.

Filling the soil pores with oil means the soil cannot absorb water so it becomes runoff during the rainy season. Pollutants in the soil will last much longer than in other parts of the biosphere, causing changes in the composition and quality of the soil, as well as dynamic systems, and ultimately resulting in an imbalance in environmental processes (21). It can be seen in the abandoned oil mining areas that have been left for years with soil still contaminated by oil waste. The soil in ol wells remains highly polluted with oil waste even though it has been left for years.

Based on Table 4, it is explained that oil waste that settles and covers soil particles causes the soil to appear thick black and oily. This condition occurs because the carbon content in crude oil is dark in color, so contaminated soil will have the same color. The soil at the research site is Vertisol soil dominated by bright yellow-brown hues with an average Hue of 10YR. The distribution of oil waste on yellow Vertisol soil can be directly determined by comparing the color of the soil with the surrounding soil because contaminated soil will darken due to trapped oil.

The surface of the soil contaminated with oil waste at the research site appears thick black due to the oil waste clotting and settling on the soil surface. The surface soil contaminated with black oil waste has a higher temperature compared to the surrounding soil, this is because black soil absorbs more heat. Pollutants such as crude oil waste that enter the soil will accumulate in the top layer of soil as the first layer to come into contact with the oil waste, causing the soil at a depth of 11-20 cm to have a lighter gray color compared to the soil above it (22). Soil color can be used as a reference in determining the types of plants that can thrive on that soil.

The results of pH testing on soil samples contaminated with oil waste as in Table 5 show that soil contaminated with oil waste has a high pH, namely 8, so the soil is slightly alkaline. The pH conditions in waste-contaminated soil which shows an alkaline pH can affect the absorption of nutrient elements by plant roots. Acidic or alkaline pH conditions cause obstacles in the absorption of nutrients by plant roots so that plant growth is hampered and plants become stunted or die. Even though some plants can survive high pH conditions, oil waste fluids can prevent plant roots from obtaining nutrients in the soil.

Types of plants that have short root systems will not survive in soil contaminated with petroleum waste, while trees with long root systems such as teak trees and karsen trees at the research location can survive. Plants have the ability to accommodate toxic substances through biochemical and physiological mechanisms, as well as being able to retain organic non-nutritive substances that occur on the root surface. Pollutants will be metabolized through oxidation, reduction and enzymatic hydrolysis (23). The soil around the miing area has low organic content, so only certain types of plants that can sorvive with little water, such as teak trees, bananas, and corn.

The soil at the research location generally has a pH of 7 or neutral so it is suitable for plants to grow well even though vertisol soil under normal conditions has a neutral to alkaline pH. Vertisol soil has low organic matter with a small number of microorganisms and nutrients in it so that not all plants can live in the research area. Other results obtained from soil samples at the distillery showed a pH of 5 so the soil has acidic properties. Oil spills from this process may contain heavy metals and organic acid compounds, causing a decrease in soil pH. Changes in pH can cause adsorption of contaminants into the soil, causing a lower pH (24).

2. The Impact of Mining on the Community's Economy

The existence of petroleum mining has caused most people to join mining groups which have been started since colonial times. The educational background of the miners on average is elementary school and junior high school graduates. Mining workers learn to mine from members of other groups or from parents who previously worked as oil miners. Petroleum mining provides job opportunities for local people to join mining groups. Oil prices from 2010 to 2023 will experience an increase in the price per liter sold by mining communities. can be an advantage for petroleum miners as crude oil producers.

Even though oil prices have increased, oil mining has been carried out since the Dutch colonial era until now, the amount of oil that can be extracted from oil wells has actually decreased. so it cannot be a hope as the main source of income to meet basic needs every day. The amount of oil removed from the well in one week by miners is around 2,000 to 3,000 liters of dirty oil mixed with water from the well. Of the approximately 2,000 liters of dirty oil removed, only around 30% to 40% of the oil is recovered, while 60-70 percent is water content. The total oil yield obtained after being separated from the water is around 600 to 1,500 liters of crude oil in one week.

People who work as miners receive wages based on payments that have been determined in accordance with the agreement with the KUD. Apart from payments to groups of miners, KUD also provides wages for lifting services for transporting crude oil from mining from the oil refinery location to the deposit site. The fee for lifting and transport services provided is adjusted to the letter of agreement regarding the terms of the agreement that has been made. The selling price of oil set by Pertamina adjusts world oil prices so that in 2022 the oil price, which was originally IDR 8,500, will be IDR 10,000/liter.

The amount of oil obtained in one week is around 600 to 1500 liters so that in one week the proceeds from oil sales are around IDR 1,000,000 to IDR 1,500,000 which is then divided between 10 and 30 members, so that each mining worker gets a wage of 30 to 30 liters. 50 thousand per person as the miners' net income. These results have been deducted as PPH costs of 2% and VAT of 10% and do not include maintenance costs for mining equipment and so on.

People consider that wages are still insufficient to meet their family's living needs, so they look for new jobs as farmers or entrepreneurs and consider working in oil mining as a side job. Most mining workers use corn and other secondary crops as their main income. This situation is caused by the increase in the number of workers so that the number of oil wells increases, besides that the oil wells that have been mined for decades have caused the oil content in Wonocolo

Village to decrease (25). However, the welfare level of the community in Wonocolo Village, most of the miners have moderate welfare, thus classified as fairly prosperous (26).

The research results show that in early 2010, people who mined traditionally from old wells began to switch to using diesel engines to lift oil. This transition can produce as much as 2000 liters of oil in one week from each active well. With the development of technology, the mining process can be made more efficient and produce more petroleum than using human power (27). The number of active wells in 2010 was around 400 and the price of petroleum per liter was IDR 5,500. This can provide big profits for the community because the weekly income reaches IDR 7,000,000 to IDR 10,000,000 per person which makes people start to join in oil mining.

Most of the people who took part in mining from 2010 used their income to build houses, pay for education and buy motorbikes or four-wheeled vehicles on credit. Compared with the current results of oil mining, which is inversely proportional because it has decreased and the number of active wells has decreased, namely around 150 wells that are still active, this makes people think that oil sources will soon run out in the next few years because new oil sources have not yet been discovered.

CONCLUSION

The conclusion of this research is: 1) Oil waste contamination prevents soil perticles from interscting with water, thus reducing the soil perticle's cohesion, which causes the soil unable to form aggregates, 2) Clay soil has very fine particle sizes that prevent waste from spreading, 3) Plans with extensive root tissue structures can survive on polluted soil because oil waste often accumulates on the soil surface, 4) Compared to 2010, the current results of oil mining are no longer sufficient to meet basic needs, so people resort to mining as side job. Therefore, it is recommended to reclaim the former mining wells and provide land to the community for new professions in agriculture

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