Merge space information and terrestrial data to study the contamination of the area of seepage from the carrier pipeline of hydrocarbons materials in the Wardia town / Babylon Governorate

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Abstract
The study included, merge the space data, with ground data, by the interpretation the space images to search for area of contamination, or seepage of hydrocarbon materials from the transporting's pipeline in Wardia/Babylon area, which is damage by natural weather or military operations or by terrorists and discover the spot of seepage using photos of Ground Penetration Radar (GPR) to repair the pipe quickly to prevent the environmental contamination which may be happened around the area.

Key Words
T.D.S. Total dissolved salts, O.M Organic matters,

1-Introduction:
The pollution of the oil carbonates in the late twentieth century was due to the increase in the manufacturing, transportation and distribution of crude oil and its products. Petroleum hydrocarbons have become an environmental problem. Large amounts of crude oil and its derivatives and industrial process waste are on their way to the biosphere due to water pollution.

Oil hydrocarbons can interact with other substances found in the soil (Langley et al., 2003)
In this study we will take a new study on the study of pollution by combining space and ground information, a new study that no one has ever dealt with. Many studies have studied soil pollution through satellite images but.

This study is the first of its kind, since researchers have never linked the study of areas of pollution by satellite images and connected with photos of ground penetration radar for the path of pipelines carrying oil.

2-Aim of study:
1- Quickly discovered any seepage from the alignment of hydrocarbon pipelines.
2- Proving that a use of both space and terrestrial data together is useful for treating the ground pollution by different ways.

3-Area of study:
The study area is located at Babylon Governorate/Wardia town; it is starts from the street leading to the house of Sheik Jaber Al-Humeiri, whose coordinates are Northing 32º 29' 43.18", easting 44 º 27' 57.64" to the road leading to the village of Al-Dulab at the N32 º 26' 44.81" and E44 º 27' 35.19" along 6 km of pipeline.

4-Method of study:
It is included two parts:
1- Office Work:
   a. Interpretation the Landsat image color composite 1x1m resolution for study the alignment of pipeline to search for the location of seepage area (Fig.1).
   b. Through the satellite image, eight areas surrounding the pipeline, we chosen possibly with oil seepage and contaminated in the area.
2- Field work:
   a. Use the Garmin GpS MAP 78S, accuracy ±5m to get the coordinates of the locations of the seepage areas and soil samples table1, and photos of GPR.
b. Collected the soil samples from 8 points to search for any pollution, by chemically analysis in Lab table2.

c. Use Ground Penetration Radar (GPR) (Fig.2), Mala model to get a radar photos for the mentioned spot of pipeline, may be seepage places.

Figure 1: Space image of the study area.

Figure 2: Ground Penetration Radar (GPR).
5- Coordinates of GPS:

Table 1: Coordinates of samples.

<table>
<thead>
<tr>
<th>NO. of point</th>
<th>Easting</th>
<th>Northing</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44° 27' 56.7&quot;</td>
<td>32° 29' 38.45&quot;</td>
<td>Sample1 fig.2</td>
</tr>
<tr>
<td>2</td>
<td>44° 27' 49.91&quot;</td>
<td>32° 29' 15.78&quot;</td>
<td>Sample2 fig.3</td>
</tr>
<tr>
<td>3</td>
<td>44° 27' 42.96&quot;</td>
<td>32° 28' 51.03&quot;</td>
<td>Sample3 fig.4</td>
</tr>
<tr>
<td>4</td>
<td>44° 27' 36.58&quot;</td>
<td>32° 28' 31.23&quot;</td>
<td>Sample4 fig.5</td>
</tr>
<tr>
<td>5</td>
<td>44° 27' 33.33&quot;</td>
<td>32° 28' 4.42&quot;</td>
<td>Sample5 fig.6</td>
</tr>
<tr>
<td>6</td>
<td>44° 27' 33.78&quot;</td>
<td>32° 27' 38.40&quot;</td>
<td>Sample6 fig.7</td>
</tr>
<tr>
<td>7</td>
<td>44° 27' 34.25&quot;</td>
<td>32° 27' 17.51&quot;</td>
<td>Sample7 fig.8</td>
</tr>
<tr>
<td>8</td>
<td>44° 27' 35.65&quot;</td>
<td>32° 26' 50.12&quot;</td>
<td>Sample8 fig.9</td>
</tr>
</tbody>
</table>

6- The work of Ground penetration radar (GPR):

It is included:

1. The technicians are taking GPR photos to the oil pipeline path in 8 locations, two photos are taken for each place when the GPR pass vertically on the ground above the pipeline which present in the subsurface, the distance between each two photos are three meters, (Fig. 11).

2. Re-read and take other radar images of the same number, but after changing the antenna of the device from three meters to 6 meters, to increase the signal reflectance depth.
Figure 11: GPR Ground penetration Radar photos.

GPR Photos:

- GPR photo 6meter
- GPR photo 3meter

- GPR photo 6meter
- GPR photo 3meter

- GPR photo 6meter
- GPR photo 3meter
8- **Soil samples tested:**

1. Collect soil samples along the course of the studied tube and on both sides of the
Pipeline (16 samples).

2. Different laboratory tests are carried out:
   a. Salinity content review.
   b. Moisture content testing.
   c. Liquid limit.
   d. Plastic Limit.
   e. Plasticity index.
   f. Chemical test.

Only selected the laboratory chemical results in this research table 2:

**Table 2: Results of chemical analysis.**

<table>
<thead>
<tr>
<th>Sample no.</th>
<th>Sample depth/cm</th>
<th>Photo NO.</th>
<th>T.D.S%</th>
<th>PH</th>
<th>O.M%</th>
<th>Gypsum</th>
<th>The dissolved soluble ions and sulphates (mml.mol.L⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SO₂⁺%</td>
</tr>
<tr>
<td>1</td>
<td>0-10</td>
<td>Photo no.1</td>
<td>1.95</td>
<td>8.77</td>
<td>2.72</td>
<td>0.43</td>
<td>25.50</td>
</tr>
<tr>
<td>2</td>
<td>0-40</td>
<td>Photo no.1</td>
<td>1.88</td>
<td>8.96</td>
<td>2.25</td>
<td>0.23</td>
<td>19.33</td>
</tr>
<tr>
<td>3</td>
<td>0-10</td>
<td>Photo no.2</td>
<td>0.93</td>
<td>8.0</td>
<td>0.11</td>
<td>0.6</td>
<td>0.23</td>
</tr>
<tr>
<td>4</td>
<td>0-40</td>
<td>Photo no.2</td>
<td>0.3</td>
<td>7.9</td>
<td>0.1</td>
<td>0.42</td>
<td>0.2</td>
</tr>
<tr>
<td>5</td>
<td>0-10</td>
<td>Photo no.3</td>
<td>0.6</td>
<td>8.1</td>
<td>0.23</td>
<td>0.39</td>
<td>0.44</td>
</tr>
<tr>
<td>6</td>
<td>0-40</td>
<td>Photo no.3</td>
<td>0.2</td>
<td>7.5</td>
<td>0.1</td>
<td>0.19</td>
<td>0.21</td>
</tr>
<tr>
<td>7</td>
<td>0-10</td>
<td>Photo no.4</td>
<td>0.02</td>
<td>6.6</td>
<td>2.3</td>
<td>0.4</td>
<td>1.2</td>
</tr>
<tr>
<td>8</td>
<td>0-40</td>
<td>Photo no.4</td>
<td>0.01</td>
<td>6.8</td>
<td>0.2</td>
<td>0.14</td>
<td>1.8</td>
</tr>
<tr>
<td>9</td>
<td>0-10</td>
<td>Photo no.5</td>
<td>1.2</td>
<td>8.3</td>
<td>2.30</td>
<td>0.07</td>
<td>19.83</td>
</tr>
<tr>
<td>10</td>
<td>0-40</td>
<td>Photo no.5</td>
<td>0.9</td>
<td>8.0</td>
<td>1.78</td>
<td>0.18</td>
<td>18.60</td>
</tr>
<tr>
<td>11</td>
<td>0-10</td>
<td>Photo no.6</td>
<td>0.15</td>
<td>8.0</td>
<td>0.9</td>
<td>0.02</td>
<td>0.18</td>
</tr>
<tr>
<td>12</td>
<td>0-40</td>
<td>Photo no.6</td>
<td>0.01</td>
<td>7.2</td>
<td>0.3</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>13</td>
<td>0-10</td>
<td>Photo no.7</td>
<td>0.11</td>
<td>7.7</td>
<td>0.5</td>
<td>0.1</td>
<td>0.04</td>
</tr>
<tr>
<td>14</td>
<td>0-40</td>
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<td>0.02</td>
<td>7.2</td>
<td>0.1</td>
<td>0.01</td>
<td>0.11</td>
</tr>
<tr>
<td>15</td>
<td>0-10</td>
<td>Photo no.8</td>
<td>0.02</td>
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<td>0.8</td>
<td>0.11</td>
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<tr>
<td>16</td>
<td>0-40</td>
<td>Photo no.8</td>
<td>0.01</td>
<td>8.2</td>
<td>0.2</td>
<td>0.01</td>
<td>0.14</td>
</tr>
</tbody>
</table>

9. Discussion:
   1. By radar images three pipelines tubes were discovered, two of which are still working now, the third pipe is out of service and stopped from a 30 years and has no hydrocarbon derivatives figure 12.
   2. Table 2 shows the concentration of positively charged cations and ions, including calcium, magnesium and sulfate. The concentration of calcium between 0.11 - 25.87 ml.mol⁻¹ and magnesium ranged between 0.02 – 22.69 ml.mol⁻¹ and sulphate between 0.04 – 25.50
ml.mol⁻¹ at the affected sediments of oil residues of samples no. 1, 5. The results indicate a high concentration of calcium and magnesium ions as well as sulphates in affected sediment soil in oil residues compared to non-contaminated areas. The reasons may be attributed to the presence of oil residues that add amounts of these dissolved ions to the soil, especially sulphates resulting from the combustion of sulfur-containing compounds such as petroleum.

Nnaji et al. (2005) mentioned increase in high concentrations of calcium and magnesium content may result from the soil’s dependence on crude oil as well as the rapid decay and mineralization of soil organic matter. These processes release the elements and cations. This is confirmed by the contribution of oil residues to the increase of dissolved ions in the soil solution Marinescu et al., (2010).

3. The organic material in Table 2 showed a clear variation in their quantities at the horizons of the affected sediments of the oil residues, in a quantity ranging from 1.78 to 2.72 kg⁻¹, which was similar to the surface samples values between the soil of samples 1, 5, compared to the non-polluted samples, soil where the organic matter ranged from 0.10 to 2.30 kg⁻¹. The results may indicate the role of the oil compounds in the contamination and increase the total content of organic matter compounds and aromatic Abii, T. A. et al. (2009).

4. The percentage of total dissolved salts (T.D.S) between (0.01-1.95) which exceeded the percentage specified by resulting in voids or cavities when melting in different sources of water (Baver, L. D. et al., (1972).)

5. There is no effect on the amount of gypsum in the soil in all the study area table 2.

10- Recommendations:

1. Must uses satellite images for looking to pollution sites quickly every were, especially along the alignment of the oil carrier lines.
2. Using remote sensing techniques, and GIS and GPS together, provides cost, effort and time to complete engineering and environmental projects, smoothly and conduct exploratory studies on pollution sites in the every were.

11- Conclusions:

From the spatial and ground data and the results of the laboratory tests, the study reached to:

1. All areas are not contaminated with hydrocarbon derivatives in the areas of samples obtained, figures (photos) 2, 3, 4, 6, 7, 8 and there is no seepage in the pipeline.
2. The contamination was in figure (photos) 1, 5 by hydrocarbon material.
3. Contaminated areas 1, 5 were due to the residues of shops to replace oil and greases of cars.
4. There are no any damages on the pipeline.
5. When total dissolved salts is increased, the soil bearing is reduced, affecting the building and construction projects.
6. The oil office tell us there are two pipeline in the Wardia area, but there are three pipelines in the area discovered by the GPR photos.
7. Oil residues contributed to the increase of calcium, magnesium and sulfate ions in the soil solution.
12-References:


