

Community Perception of Odour Pollution and its Impact on Surrounding Area: A Case Study in Kwashe Industrial Area, Kurdistan Region-Iraq

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ABSTRACT

Background: Odour is an important factor in assessing the quality of life in any area and cities. Odour pollution from industrial area is one of the contaminants that affects human environment and negatively impacts human health and social well-being. Further, the spread of Odours in the neighborhoods around industrial regions can exacerbate social unrest and lead to public complaints about the quality of the air.

Objective: To conduct and gather a community perception of Odour pollution caused by industrial sources and the health status of those population living near and around the source.

Methods: The searches were conducted in March, June, September in 2022 and January and February in 2023. Data were collected by means of questionnaires at 10 sites near and around the industrial area. This study analyses comments from the people living within 1 to 15 km radius around an industrial area to gauge and determine how they perceive and experience being impacted by smell pollution. In order to ascertain the impact of industrial area Odour on social, health, and comfort levels, one aspect of the study comprised a perception survey. The disagreeable Odours' magnitude, persistence, and intensity were controlled by the other component.

Results: From this study, 140 people responded. The results demonstrated that the strong disagreeable smell was normally experienced in summer. The findings also demonstrated that the industrial area smell had caused daily discomfort and continuously. Because the respondents experience a variety of unpleasant Odours that negatively affect their perception of their quality of life, the data from the research allow us to state that certain smells are so oppressive that they may force the need to leave the place of living.

Conclusions: Results highlight the significance of smell pollution for the population living near and surrounding industrial odour sources in terms of public health. The limited evidence for the majority of results supports the need for high quality epidemiological researches on the relationship between odour pollution and its effects on human health. In conclusion, the analysis of the smell impact demonstrates a substantial effect on the residents of the area under study. The impact might be felt up to 15 kilometers away, especially in the closest area.

Recommendations: It is essential that the relevant authorities conduct mitigation measures, and these pollutants must be thus controlled and regulated. While formulating legislation or making choices concerning industrial regions that also provide environmental preservation, policymakers should take public perception into account.

Keywords: community perception, industrial area, local public, mitigating measures, odour pollution and intensity.

I. INTRODUCTION

One of the major problems, both locally and nationally, is Odour nuisance. This is a result of how smells affect human behavior and their quality of life [1].

Due primarily to the olfactory annoyances produced during industrial production processes, Odour emissions from industrial sites pose a serious health risk to both workers and nearby communities [2, 3]. When there is greater industrial activity close to residential areas, the Odour pollution is extremely disturbing [4].

The upper respiratory tract is typically the first area of the human body where air contaminants enter, making the olfactory function

crucial in the detection of environmental risks. Several authors today believe that there is a connection between Odours, the sources of their emissions, and how they affect people's quality of life, particularly in the context of their place of residence [5, 6], as well as social and economic relationships [7, 8].

While the triangle Odour bag technique was used in Japan, Odour measurement using a dynamically olfactometer is commonly used in Europe [9]. Together with the olfactory measurement technique, controls, comparisons, and a qualitative analysis of community perception were also conducted. Dispersion modeling was sometimes included in the perceptual studies [10].

Among other things, fragrances have an impact on daily life [11], consumer choices [12], employee health, and general health [13].

The symptoms of chronic Odour exposure, such as headaches, nausea, attention deficit disorder, appetite loss, stress, insomnia, and discomfort, have an impact on quality of life, especially the residents of neighborhoods close to the industrial area [14].

Headaches, eye discomfort, and unusual fatigue have all been linked to environments that smell terrible, have mold, or have poor air quality [15]. Physiological factors, age or sex, prolonged exposure, perceived health risks, and numerous social circumstances can all affect an individual's sensory reactions [16]. Those with smell sensitivity seem to experience Odour-related symptoms more frequently [15].

By accepting the location of residence, it is crucial to understand and influence residents' expectations and opinions of the quality of life [17]. The social behavior of residents and the sort of industry present in the area are increasingly taken into account in research [18].

A questionnaire survey for the population affected by the Odour source can be used to analyze the air quality in relation to Odour perception. Since Odour exposure is primarily a human experience, researching a community might be useful for Odour evaluation [19].

One of the most frequent public complaints about air quality to authorities has been Odour pollution annoyances, which have grown in

importance as a social concern in developed nations [20]. In order to avoid, control, and reduce the impact of Odour on communities, monitoring technologies are required [21].

Since observable scents can affect every day moods and people's psychology and physiology, industries have a responsibility to guarantee that their intended performance does not harm the environment [22, 23].

With reference to the occurrence, duration, locations, and the impact of environmental factors, this study aims to determine how the community perceives the source of the offensive Odour. The study also aims to examine how the community views the effects of Odour on people and the physical environment, as well as how strongly Odours are perceived by human noses.

The Kurdistan Region of Iraq needs this study badly because there have been many complaints about scent in the media. The results achieved can improve environmental protection.

II. MATERIAL AND METHODS

Site description

The study area was situated in the Kwashe industrial area (Figure 1), which is one of the most rapidly growing and polluted industrial areas [24]. This area is home to numerous factories such as oil refineries, tanneries, dyeing, steel, and cement, all of which operate in an illegal, unscientific, and not environmentally friendly. In the Kurdistan region, Kwashe is an industrial sector located 20 kilometers to the west of Duhok [25]. This region is located between 36.9906°N and 42.7894°E longitudes [26, 27]. The Kwashe industrial area also features a landfill and a sizable facility that separates solid trash; it receives over 900 tons of municipal solid waste annually, of which 50% is organic kitchen waste [26]. The load of municipal waste is more than the capacity of the waste separation plant, so a significant portion of these wastes are discharged straight into the open landfill. After some waste separation, roughly 40% are thrown into an open landfill in a neighboring valley without any separation and treatment [27].

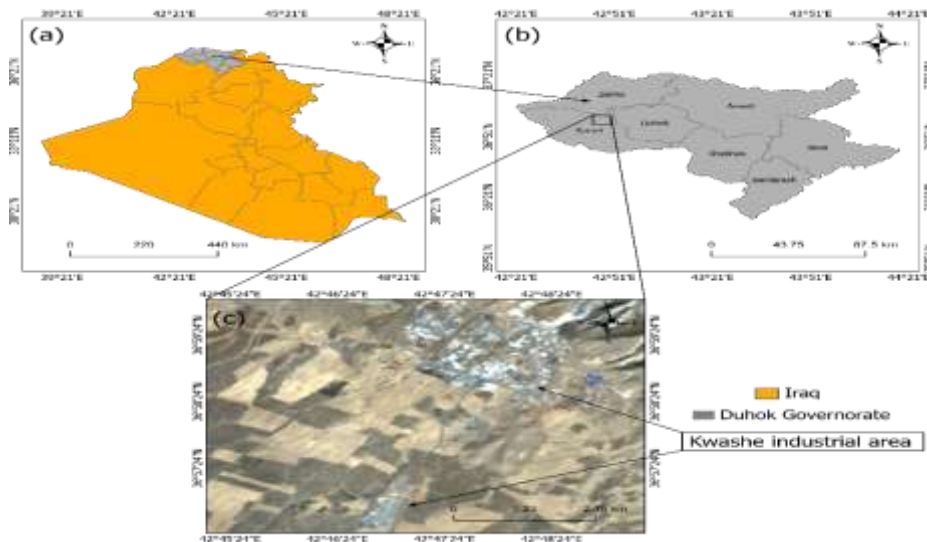


Figure 1:The location of Kwashe industrial area in Kurdistan Region, Iraq

Data collection and Questionnaire survey

The information was gathered from 140 respondents at different places that were each affected by Odour. The respondents were split into four groups: those who lived in modern housing, traditional villages, those who own businesses and those who work in institutions and training facilities. 140 questionnaires in all were distributed throughout a 15 km radius of the industrial sector. Only those who lived in the study area were considered the study's sensitive recipients. Throughout the survey, the respondents were questioned close to their residences to learn how they personally perceived the effects of the scent from the industrial area. They were asked to indicate if there was a strong, medium, weak, or no Odour at all.

III. RESULTS AND DISCUSSION

About 60% of the population was male and 40% was female. The minimum and maximum respondent ages were 12 and above, respectively. Age-wise, the 33–39 age group had the largest percentage (23.58%), followed by the 26–32 age group (20.71%), the 19–25 age group (20%), the 12–18 age group (17.14%), and the above 39 age group (18.57%).

The average respondents (42.86%) had completed their primary and secondary education, with 12.86% having completed high school. Respondents with higher education were divided into two categories, college and university, with a percentage of (17.14%). The remainder (27.14%) was made up of older people with no formal education or limited education.

Table 1:Distribution of Socio characteristics of respondents.

Gender	Frequency	Percentages
Male	84	60%
Female	56	40%
Age	Frequency	Percentages
12-18	24	17.14%
19-25	28	20%
26-32	29	20.71%
33-39	33	23.58%
Above 39	26	18.57%
Educational level	Frequency	Percentages
Primary	33	23.57%
Secondary	27	19.29%
High school	18	12.86%
College and university	24	17.14%
Illiteracy	38	27.14%

While the majority of responders (92.14%) were upset by the scent, (89.29%) agreed that the industrial area were the source of the foul Odours. The magnitude of air pollution from this industrial sector, which has been present for a long time, has increased steadily due to carbon dioxide emissions, which have removed oxygen from the atmosphere as a result of the operation of the enormous number of these plants [28].(11.43%) of the total 140 responders have made some kind of complaints about the offensive Odour. The remaining (88.57%) respondents did not file a complaint for a variety of reasons, including:

(20.97%) not knowing where to file the complaint; (27.42%) not caring; and (51.61%) believing that someone else would file the complaint on their behalf. The respondents who filed complaints did so in person with the local authority. Some had accomplished this through a variety of various strategies, including elected officials, housing associations, and electronic media including radio, television, and social media. According to the data, (59.29%) people migrate because of smells, while (40.71) individuals follow but stay put.

Table 2:The opinion of the respondents about the source of the Odour and the inconvenience, complaints and migration due to these Odours

Are malodors coming from the industrial area?	Frequency	Percentages
Yes	125	89.29%
No	15	10.71%
Does the smell annoy you?	Frequency	Percentages
Yes	129	92.14%
No	11	7.86%
Have you got a complaint?	Frequency	Percentages
Yes	16	11.43%
No	124	88.57%
Why did not you voice any complaints?	Frequency	Percentages
I did not know where to make the complaints	26	20.97%
I did not care	34	27.42%
I thought others would make the complaints on behalf of me	64	51.61%
Do people migrate because of smells?	Frequency	Percentages
Yes	83	59.29%
No	57	40.71%

According to this study, when the malodor was detected could be divided into three different periods: the morning, the evening, and the entire day. Intriguingly, according to the study, (52.86%) of the participants said they could smell a bad Odour all day, followed by at night (40.71%) and in the morning (6.43%). In general, (90%) of the respondents firmly believed that bad Odour was the major environmental issue they were facing. Other research indicates that the pollution of the Kwashe industrial area is one of the causes of air, water and soil pollution in the surrounding area [29].

The frequency of the odour pollution was evaluated under four major situations. They occurred once daily, once weekly, once monthly, and the whole day. According to the findings, the issue of Odour is one that affects everyone on a daily basis, is ongoing, and is responded to by (47.86%) of respondents, followed by once a day (27.86%), once a week (20.71%), and once a month (3.57).

According to the survey, the smell would eventually go away, but the rate at which it would do so was unknown and thought to be dependent on the general weather conditions by (62.85%) of the respondents. Of the respondents, (12.86%) said the smell was going away, followed by (24.29%) who said it was not.

One of the environmental factors that may affect the respondents' sense of Odour frequency and intensity is weather. The amount of Odour conveyed can be influenced by weather factors as humidity, temperature, wind speed, and direction [30]. The study's findings revealed that the majority of participants thought the weather had something to do with the smell of pollution near their neighborhood's industrial region. According to the study, (29.29%) of participants said the wind, rain, and hot weather had an impact. With regard to this, the wind's influence was thought to be the most significant (38.57%), followed by rain (27.14%) and hot weather (5%).

People reported that they can detect a terrible Odour at all times of the year, but summer has the strongest smell (50%), followed by autumn

(11.43%), spring (9.29%), winter (6.43%), and (22.85%) of respondents said they are constantly aware of the smell, regardless of the season.

Table 3: Respondents opinion about the duration, appearance and effect of unpleasant Odours

Detectable malodor periods	Frequency	Percentages
Morning	9	6.43%
Night	57	40.71%
Whole day	74	52.86%
largest environmental problem they are now confronting	Frequency	Percentages
Air pollution	7	5%
Water pollution	3	2.14%
Noise pollution	2	1.43%
Dusts	2	1.43%
Foul smell	126	90%
Frequency of the odour pollution	Frequency	Percentages
Once a day	39	27.86%
Once a week	29	20.71%
Once a month	5	3.57%
Whole day	67	47.86%
Are the smell disappeared?	Frequency	Percentages
Yes	18	12.86
No	34	24.29%
Dependent on the weather	88	62.85%
Weather factors	Frequency	Percentages
Wind	54	38.57%
Rain	38	27.14%
Hot weather	7	5%
All components	41	29.29%
Which season has the most smell?	Frequency	Percentages
Summer	70	50%
Winter	9	6.43%
Autumn	16	11.43%
Spring	13	9.29%
All season	32	22.85%

The three categories of inside, not sure, and outdoor were used to categorize how the population perceived detectable Odour. The study's findings revealed that indoor (7.86%) and outdoor (85.71%) Odours were considered as the worst by the respondents. Also, (6.43%) of the respondents were unsure of where the worst Odour was typically found. The common community practice of closing all doors and windows to prevent unpleasant Odour from entering indoors was probably the main cause of the noticeable difference in the perceived foul Odour between indoor and immediately outside the house. As one traveled through the area in an air-conditioned automobile or went for a walk in the parks, the offensive smell was less noticeable. This was most likely the cause of the poor rating for perceived unpleasant Odour outside.

The human nose's sense of smell is crucial in determining the level of perceptible Odour. According to the poll, there are four major categories in which the community perceives Odour intensity: no Odour, a somewhat unpleasant stench, a medium-strong Odour, and a strong Odour. (62.86%) of the respondents reported smelling something strongly, followed by medium malodor (18.57%), weak scent (15.71%), and no smell (2.86%).

The study's last focus is on how people perceive how Odour affects their health and the environment. According to the survey's findings, (87.86%) of participants thought that the Odour had harmed their quality of life and peace of mind. (84.29%) of the respondents also believed that their poor health was related to the offensive Odour. Only (15.71%) of respondents who were asked

about the physical surroundings associated the appliances.
 Odour with corroded household items and

Table 4:The respondents perceived detectable, intensity and impacts of odours

Detectable odour	Frequency	Percentages
Indoor	11	7.86%
Outdoor	120	85.71%
Not certain	9	6.43%
Odour intensity	Frequency	Percentages
No smell	4	2.86%
Weak unpleasant smell	22	15.71%
Medium malodor	26	18.57%
Strong Odour	88	62.86%
Impacts of odour	Frequency	Percentages
Health	118	84.29%
land use	56	40%
Peace environment	123	87.86%
Population moved	51	36.43%
Rusty equipment	22	15.71%

IV. CONCLUSION

This study is an early attempt to comprehend the problems with the Odour coming from the Kwashe industrial region. This study's contribution is factual proof that the neighborhood residents' daily lives were disrupted by the foul Odour coming from the industrial region. It was observed that the households outside activities were constantly hampered by the foul Odour. The growing number of Odour nuisance complaints attests to the severity of the issue. Residents had to close all windows and doors in order to reduce and prevent smelling the foul Odour because it was more prevalent at night. The study also revealed that the weather, particularly the wind direction, may have an impact on the frequency and intensity of foul Odours. The industrial area's major impact on the study area's air quality is evident from the investigation of its scent impact. The range of the plant's impact may even reach up to 15 km, especially in areas close to the industrial area. The results of this study highlight the significance of Odour pollution for the population living close to industrial Odour sources in terms of public health. Studies should be conducted on vulnerable populations, such as workers and pregnant women, as well as children. With the expanding efforts to control Odour pollution, it is critical to establish standardized methodologies for estimating its effects on population health and to offer scientific proof recommendations to close the gap from a public health standpoint.

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