
Management Concerns Regarding Storage and Sale of Petroleum Products by “gaddafi” in Kinshasa/DRC

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doi: 10.51505/ijaemr.2022.8108

URL: <http://dx.doi.org/10.51505/ijaemr.2022.8108>

Abstract

This study focuses on the handling of petroleum products (petrol and gasoline) by traders commonly called “Gaddafi”: storage and sale in Kinshasa. Despite the fact that the country officially has many ways of petroleum products supply and a distribution system, there are parallel supply and distribution. The handling of the parallel system represents a concern for the population and the environment, and even the engines using the products. Cases of ignition and fire due to mismanagement of petroleum products have been observed in the DRC. Many suburbs of Kinshasa, where petroleum products are stored, are characterized by houses built without standard and the lack of security infrastructure for flames; the study has led to finding that the business of the so-called “Gaddafi” is carried out without typical regulation and carelessly.

Keywords: Petroleum products, Gaddafi, Storage, Sale

1. Introduction

The crude oil is derived from a wide variety of organic matter transformed biogeochemically over the years. This fossil resource is both fuel and raw material. Its large-scale exploitation has been the pillar of industrial development in the 20th century. It probably will be one of the major components of the 21st century. The use of oil has effectively and fundamentally influenced the world on the socio-economic, political, environmental, and strategic levels (Biteau *et al*, 2017). Hydrocarbons, mineral oils, kerosene, gasoline, lubricants, paraffin, greases, solvents... and motor oils are refined products derived from crude oil by distillation. Most often, some of these refined products (such as petrol and diesel) have a unique chemical footprint characteristic of the original crude oil and refining processes (Boscard, 2006), however this study does not intend to consider the chemical properties of petroleum products.

These products are useful for humans in many domains, including transportation, agriculture, pharmaceutical industry, and petrochemical industry. Whatever the usage, their management requires compliance with norms of international organizations such as ISO, AFNOR, ASTM, API, etc. Failure to comply with these norms and directives can lead to very unfortunate consequences; it can be the case with contamination of water, soil, or air. Therefore, it has been

reported that one litre of used motor oil is enough to pollute 28 Olympic swimming pools filled with water (Stout and Wang, 2008).

1.1. Principles of Storage of Petroleum Products

The best fuel storage conditions can be described as follows: the container must meet criteria so that petrol or diesel does not degrade. Tanks installed in the open air must be suitably designed. In particular, the opacity of the reservoir must be sufficient to prevent the alteration of the characteristics of the stored petroleum products. All metal parts (tanks, pipes, and other accessories) must be connected to the earth by an equipotential bonding. Receptacles or reservoirs must be fitted with a second sealed envelope and be designed in such way that any loss of tightness of the envelope can be observed. Finally, no water supply, wastewater, gas, or electricity supply tubes must pass either under transportable containers and under tanks, or into retention basins of the refined petroleum products. As for approved jerry cans, cans, and drums (Figure 1), they offer a practical solution for transporting fuels. Their capacity must be 60 litres maximum for individuals and 450 litres for companies.

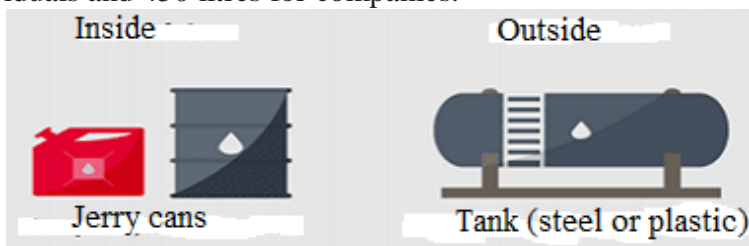


Figure 1: Tanks for the storage of petroleum products

If containers are made of plastic, HDPE (high-density polyethylene) is indicated for its tightness and composition suitable for the storage of petroleum products. The container must have the characteristics indicated (Sallé and Werlé, 2016) below:

- Opaque, prevents the light and sunlight from altering the quality of the liquid,
- Some cans contain a dye that retards the penetration of UV rays, for optimal protection,
- Equipped with a perfectly airtight container or jerry can closure system; with a device to facilitate its transport (handle, etc.) and a label by specifying its contents.

If it is a tank-type reservoir, the one made of steel (norm EN12285) or plastic (norm EN13341) model should be best. It is also important to check that its usage is indicated for the storage of petroleum products. The reservoir must be (Sallé and Werlé, 2016):

- Equipped with a gauge to assess the amount of fuel remaining through a perfectly sealed opening device,
- Identified by a visible plate clearly indicating the nature and quantity of the product.

Any container used for the above purpose must be placed away from light and moisture to optimize fuel storage conditions; it also should be placed away from excessive temperature variation.

1.2. Consequences of unrestricted storage and toxicity of petroleum products

The Fuel storage in inappropriate conditions can lead to fuel loss, quality deterioration, evaporation, or dispersion. Fuel vapours are toxic to humans and also represent a risk of fire or explosion in contact with flame. Fuel stored in a leaky container can also oxidize on contact with air; polymerization or gum particles can then be formed. Oxidized fuel can be recognized by its odour and colour which is different from regular fuel. It also has a lower in cetane index. The use of degraded fuel can cause damage to the engine (Chanlett, 1973). Some of the petroleum products used at temperatures close to their ignition temperature can endanger handling, storage, transportation, and the sale process. Trauma and burns are listed among the main hazards related to an explosion and mismanagement of petroleum products.

1.3. Health risks

Hydrocarbon vapours can cause anoxia or suffocation from lack of oxygen, with discomfort which can be fatal. These situations occur with gaseous hydrocarbons or vapours of highly volatile liquids in high concentrations (petrol, solvents), emitted by a leak in a pipe or a tank, or spilt on the ground by the breakdown of the container or accidental spillage, in confined, poorly ventilated places (cellars, underground galleries, etc.), by producing an asphyxiating atmosphere which can induce serious respiratory consequences, which can go as far as a coma. The inhaled petroleum product vapours enter the lungs, pass through lipo-skin tissue and, through the bloodstream, diffuse throughout the body and pass into the blood, then into the heart and brain, with potential actions on the bone marrow, and the central nervous system (Carney, 1994).

Environmental impacts assessment and toxicity of petroleum products have been reported in several countries in Africa and around the world (Kloff *et al.*, 2010), but to the best of our knowledge, no similar study was found for Kinshasa/DRC. Thus, this study was carried out in order to analyse the issue of storage, sale, and handling of petroleum products in the Democratic Republic of Congo, particularly in Kinshasa, by sellers commonly referred to as "Gaddafi", and finely examine reasons of numerous complaints reported on fire related to petroleum products.

2. Study area and data collection

2.1. The Study Area

This study is related both to the impacts of petroleum products on engines (vehicles) and the safety of people and the surroundings associated with their usage in Kinshasa (in the Democratic Republic of Congo) where this study was carried out. The city of Kinshasa is organized in 24 municipalities. It is supplied with petroleum products via the western route, which is one of the three in the country (Figure 2). The surveys were carried out in some municipalities of Kinshasa, which are: Masina, Ndjili, Ngaba, Lemba, Matete, Bandalungwa, Makala, Selembao, Ngiri-Ngiri, Limeté, Kalamu and Mont Ngafula.

2.2. Petroleum products supply

Any importing (Figure 2) and trading petroleum products activity in the DRC is subjected to the prior authorization of the Minister in charge of petroleum (authorizations are issued for a renewable period of one year (Beyasiku, 2008). Two distinct operations arise from these authorizations:

- Import and trade authorization: it gives the right to import and trade;
- Trade permit: this authorization allows purchasing for the sale of petroleum products from an importer.

The transporting and storing petroleum products in DRC requires one of the following permits:

- Transport-storage authorization: it allows the holder to transport and/or store petroleum products for a volume equal to or greater than 10 m³ per process;
- The transport-storage permit: authorizes its holder to transport and/or store petroleum products for a volume of less than 10 m³ per process.

However, it was found that most “Gaddafi” import petroleum products from others ways not hereby described.

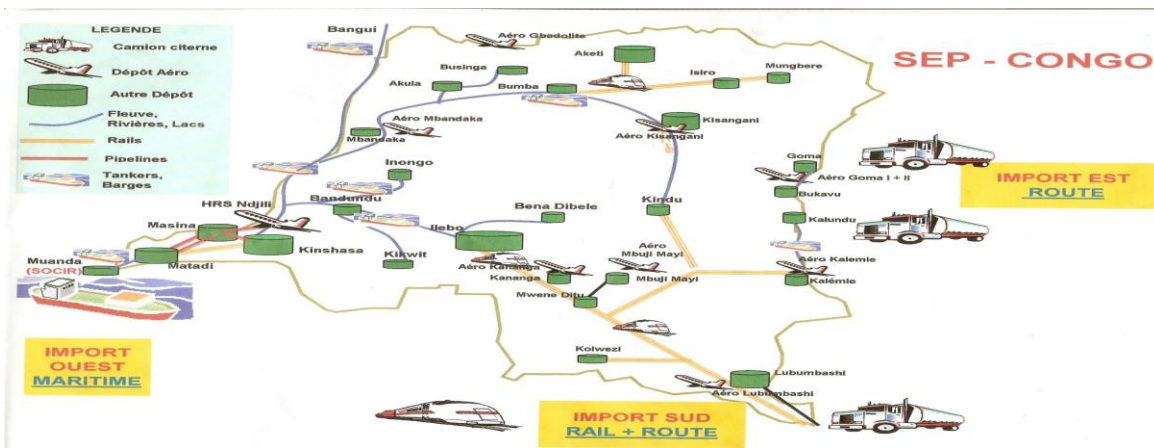


Figure 2: Supply routes for petroleum products in the DRC (in yellow)

2.3. Data collection

Data collection consisted of several tasks, including:

- Administration of the questionnaire,
- Verification of awareness of the people exercising this profession of "Gaddafi" as well as the verification of the vessels used for storage of petroleum products and other related safety assets.

It should be noted that in the DRC (Zaire), street fuel sellers without specific equipment such as "filling stations" are called "Gaddafi". This term arose from the conflict between former President Mobutu (of Zaïre) and Gaddafi (President of Libya). President Mobutu has sought to reduce his homologous status to a mere fuel salesman.

❖ Storage system and places of sale of petroleum products

The “Gaddafis” sell petrol, fuel oil, and lubricants that are stored in ordinary plastic containers that are also used for household purposes. Except for sellers of large quantities (dozens of drums)

who may have yards specially allocated for this usage, all the others store their petroleum products in their homes.

The sale is made along the streets where vehicles circulate. Very often, these products are either hidden behind the wares of other sellers to escape police control or fully exposed while defying them (officially, this trade is not authorized).

❖ *Categorization of respondents*

During the data collection process, we noticed that it was interesting to categorize the respondents in order to have consistent information. Thus, the distribution of the strata of the surveyed population is presented as follows (Figure 3):

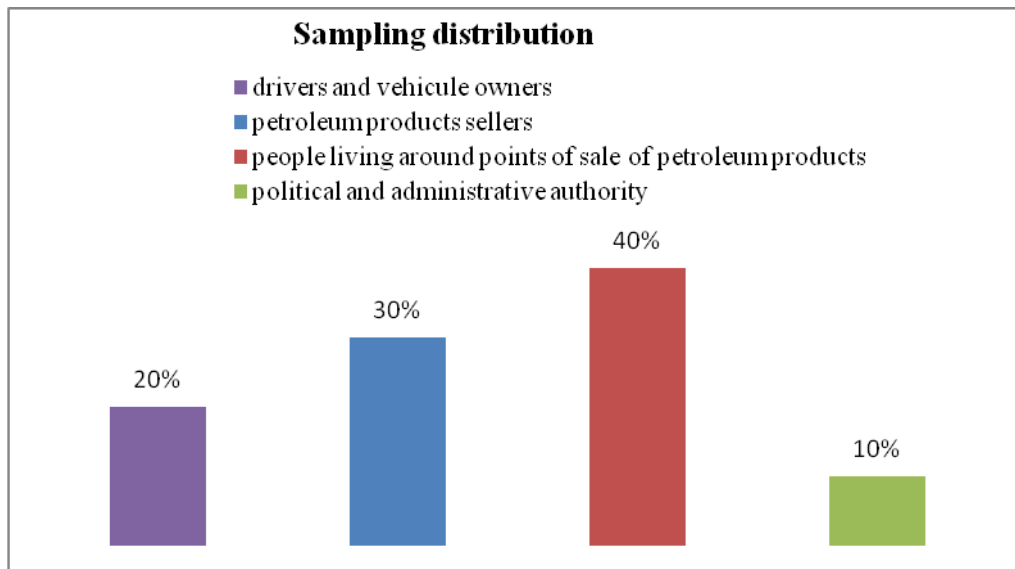


Figure 1: Distribution of surveyed population

Questions were administered to four groups of respondents who are: sellers of petroleum products, drivers and owners of vehicles, people living around petroleum product outlets, and political and administrative authorities.

3. Result and discussion

After the investigation, many places of the sale were located in different Municipalities mentioned above. The map (Figure 4) shows various locations sampled (in blue) where petroleum products are sold. The mapping is alarming and provides information on a permanent danger due to the proximity of the sale points as they represent a high risk of fire, contamination of soil and water (infiltration), degradation of product quality, etc. It was found that almost all of the petroleum products sold by the “Gaddafi” in Kinshasa go through the informal circuit, different from the supply routes shown in Figure 2, and therefore pose several safety and

probably qualitative worries. It was also found that the unsold petroleum products are day and night kept home, which is mostly built without standards.

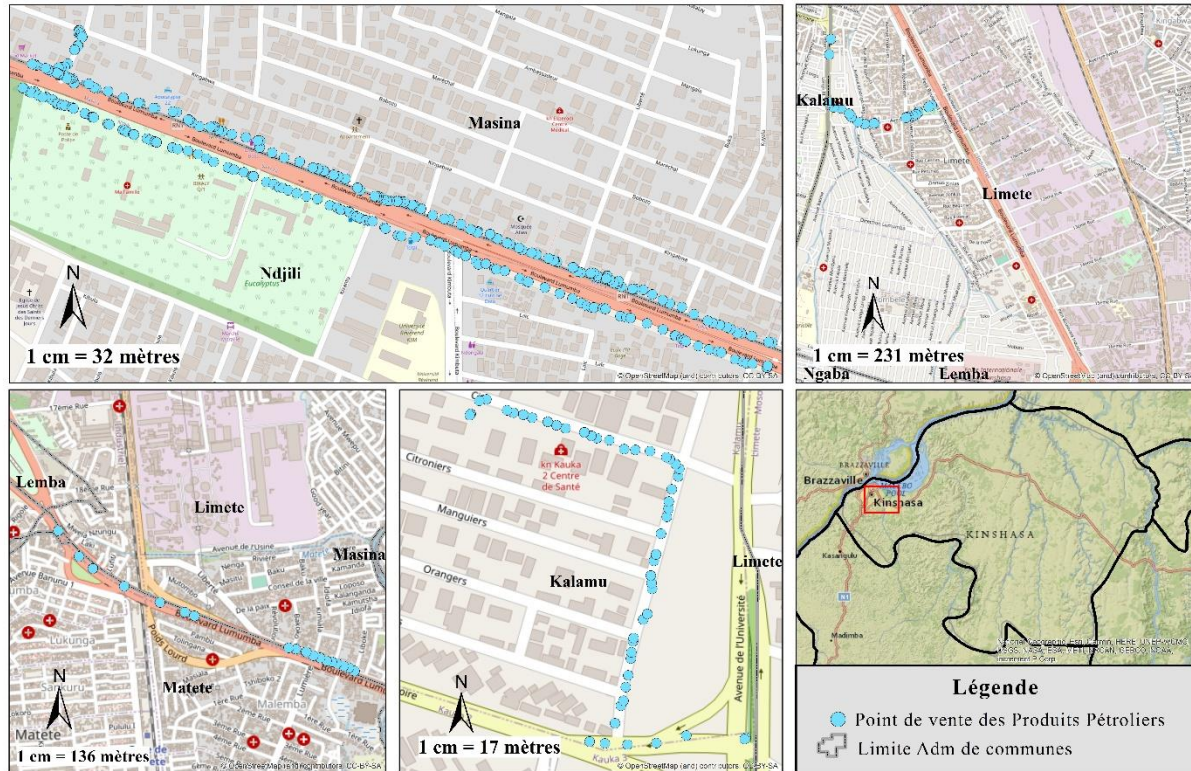


Figure 4: Map of petroleum products sale by the “Gaddafi” in Kinshasa

The image of the display and sale of petroleum products in Kinshasa (Figure 5) suggests that appropriate measures are not taken into account to limit the risks associated with the handling of these products, which are two types: health risks (asphyxiation, ingestion, skin contact, carcinogenic risk, etc.) and environmental risks (fire or explosion).



Figure 5: Display and sale of petroleum products in Kinshasa

When sellers responded during the survey (Figure 6), it was found that despite the fact that the danger related to the management of petroleum products is well known, carelessly the “Gaddafi” conduct their business without authorization or necessary training. The challenging results are certainly a serious concern for the regulatory authority regarding the management (importation and sale) of petroleum products.

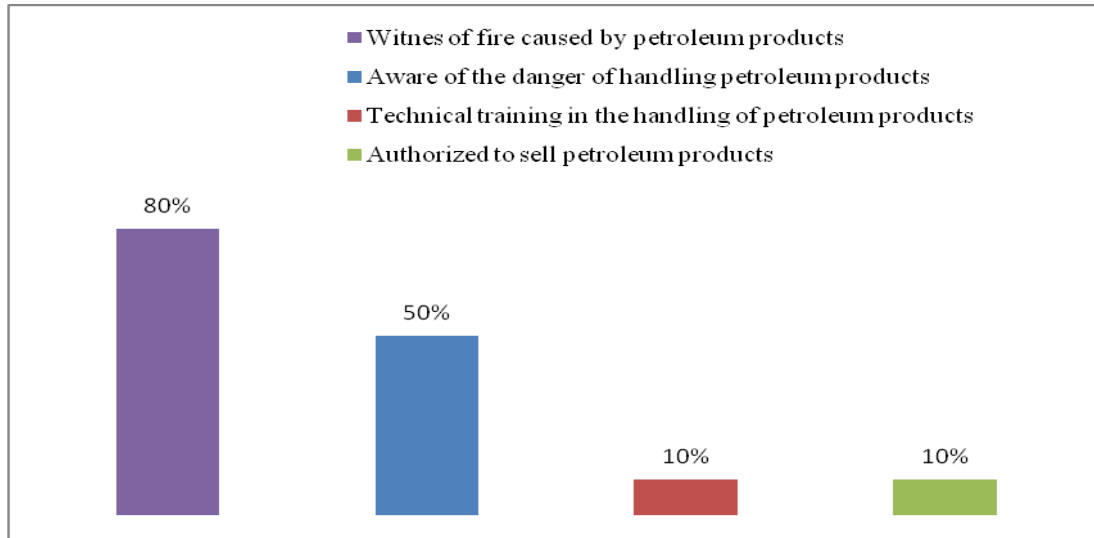


Figure 6: Results of the vendor survey

For most of the drivers and owners of vehicles, the use of petroleum products from “Gaddafi” is totally disapproved (Figure 7), even though many still buy for reasons such as i) unconsciousness of drivers and ii) if the run out of petrol happens far from the filling station.

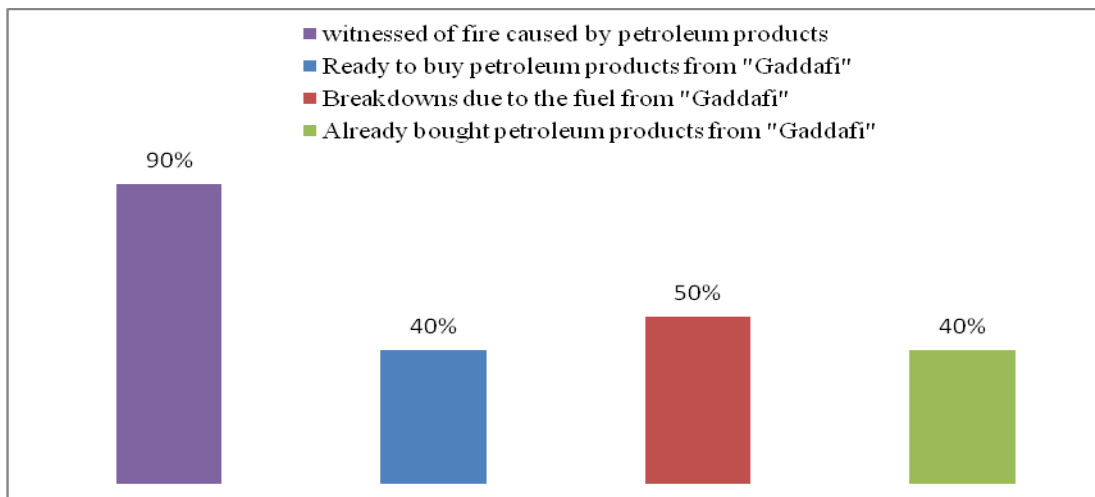


Figure 7: Results of the survey of drivers and vehicle owners

Though safety is uncertain for people living around the places of sale, they are powerless to confront sellers and stand for their rights, because of the attraction of the profit offered thereof. There are people who have dared to complain (Figure 8) about the mismanagement of petroleum products but without success.

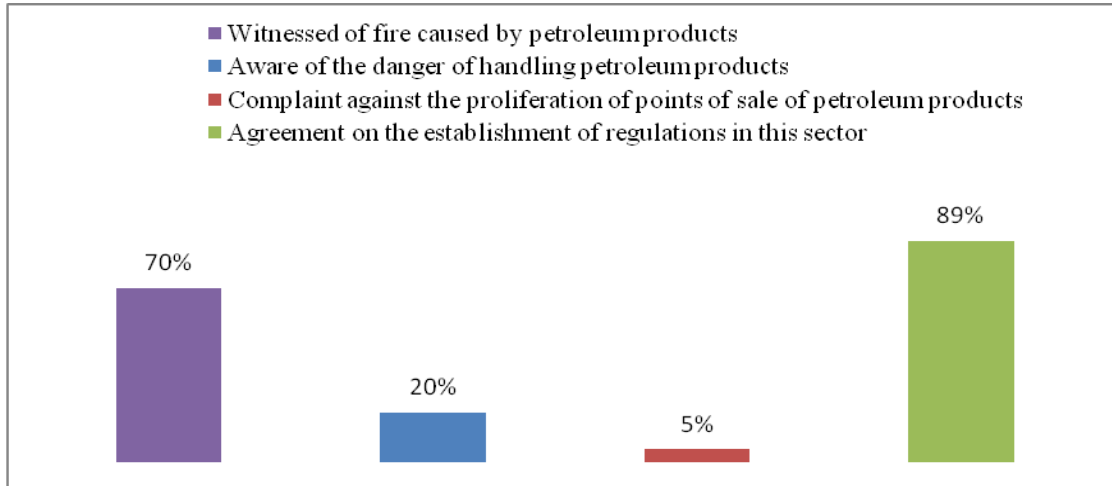


Figure 8: Results of the survey of residents around petroleum product sales points

The very strange thing is that the administrative authorities (in the municipal services) are all aware of the risk related to the storage and sale of petroleum products by the “Gaddafi” (Figure 9) however, for unknown reasons these activities are flourishing in Kinshasa. Although requirements of storage and sale of petroleum products exist and are well known, the concern remains because they are not useful for the “Gaddafi” and the culprit is only prosecuted when there is a disaster.

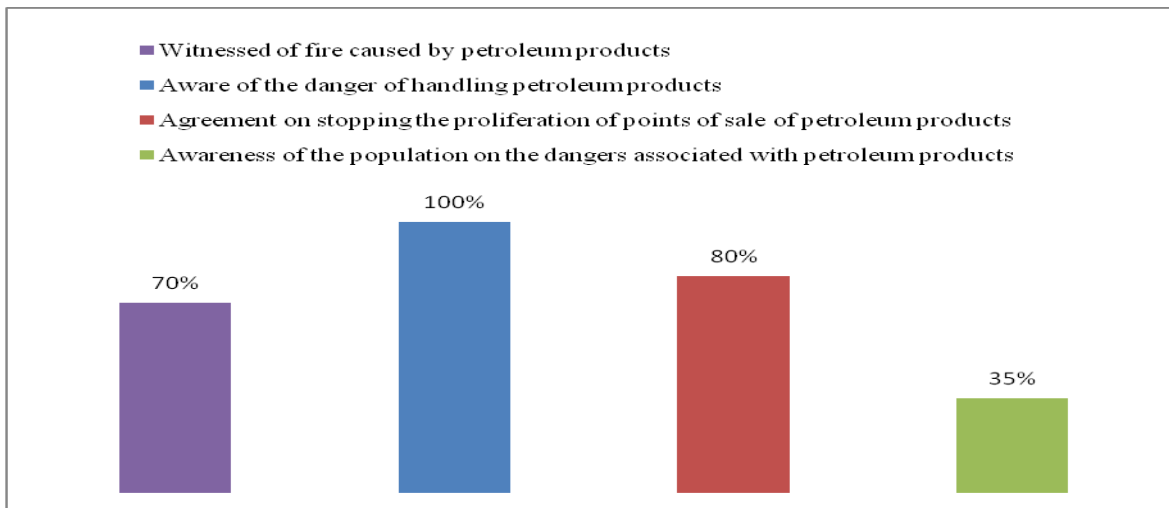


Figure 9: Results of the survey of political and administrative authorities

Conclusion

In Kinshasa, the risks of suffocation and fire or explosion related to the storage and sale of petroleum products are numerous due to their geographical distribution. The people as well as many municipal authorities acknowledge the dangers related to this activity of the “Gaddafi”, but the business seems to be accepted as inevitable. Unfortunately, many cases of accidents have been reported (fire, death, destruction of property, etc.) linked to petroleum products that took place across the country, particularly in Kinshasa. To our knowledge, this paper is a piercing scream for appropriate measures in this business.

Acknowledgments

The authors acknowledge every person who accepted and facilitated the survey to be conducted, especially the municipalities' authorities.

References

- Biteau, J.; Baudin, F. et Pouyanné, P. (2017). *Géologie du Pétrole, Historique, Genèse, Exploration, Ressources* Dunod, 11 rue Paul Bert, 92240 Malakoffcette
- Christian, B. (2006). *Marées noires et sols pollués par des hydrocarbures*, Enjeux, Editions TECHNIP,
- Stout, S.A. and Wang, Z. (2008). *Diagnostic Compounds for Fingerprinting Petroleum Environmental Forensic in the environment*. In: *Environmental Forensics*. Edited by R.E. Hester and R.M. Harrison. RSC, Cambridge, UK, 54-104
- Agricultures & Territoires/ Chambres d'Agriculture AUBE (2016). *Les principales règles d'installation d'un stockage d'hydrocarbures a la ferme: A destination des exploitants agricoles et des conseillers*, https://aube.chambre-agriculture.fr/fileadmin/user_upload/Grand-Est/046_Inst_Aube/Interface/RUB_Environnement/plaquette_hydrocarbures.pdf, visited 20/01/2021
- Sallé, B. et Werlé, R. (2016). «Stations-services et autres stations de distribution de produits pétroliers Prévenir les risques lors des opérations de maintenance», Edition INRS ED 6256, pp 48-57
- Chanlett, E. T. (1973). *Environmental protection*, New York, N.Y., McGraw-Hill Second Edition, pp 454
- Carney, E. W. (1994). «An integrated perspective on the developmental toxicity of ethylene glycol», *Reproductive Toxicology*, 8(2), 99-113
- Kloff, S.; Wicks, C. and Siegel, P. (2010). *Gestion environnementale de l'exploitation de pétrole offshore et du transport maritime pétrolier*, Dans le cadre du PRCM et avec la participation financière de la DGIS et de la Fondation MAVVA, N° ISBN: 2-9514914-5-X

- Beya, S.G. (2008). Mise à jour du secteur congolais des hydrocarbures Potentialités et opportunités d'investissement, pp35-36
- Ball, A.S; Pretty, J.N and Mahmud R. (2008).Microbial techniques for environmental forensics, In *Environmental forensics*,ISBN: 978-0-85404-957-8, DOI: 10.1039/9781847558343-00017
- Colombano, S.; Guérin, V.; Saada, A.; Hiez, D. et Bomer H. (2008). Les Diagnostics - Objectifs, enjeux & moyens, La mesure des hydrocarbures flottants, Journée Technique d'information et de retour d'expérience de la gestion des sols pollués, BRGM, environnementaux et traitement des pollutions, IFP publications, Ed TECHNIP.