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COMPARATIVE ANALYSIS OF RESULTS BY ACCREDITED AND NON ACCREDITED LABORATORY FOR WATER AND SOIL SAMPLES

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ABSTRACT

The accreditation in the field of testing has great importance in today's scenario. Specially after the second world war accreditation come into the existence to avoid the retesting, time and cost-saving, reliability of the results, and acceptance of the results for various purposes. There are thousands of testing laboratories in our country and numbers are still growing. It has been observed that many government labs are not accredited but producing very good testing results. But the number of these type of labs are very limited. In the current study, coded samples of soil and water were analyzed from accredited and non-accredited laboratories. Assessment of pH value and Water-soluble Sulphate were carried out in soil samples using IS methods. Similarly, for water samples various parameters such as pH Value @ 25.0°C, Chloride as Cl, (mg/l), Organic Impurities determined at 105 °C (mg/l), Inorganic Impurities determined at 105°C, (mg/l), Total suspended solids determine at 105 °C, ml of 0.02N, NaOH used for 100 ml Water (Acidity), ml of 0.02N, H_2SO_4 used for 100 ml Water (Alkalinity), Sulphates as SO_4 (mg/l). Soil and water samples have been analyzed by the accredited and non-accredited laboratory for comparative analysis to report the difference in the results produced by the accredited and non-accredited laboratories. Our study indicates that the results produced by the accredited laboratory can be verified with another accredited laboratory through quality check activities. The accreditation in India is voluntary therefore any laboratory may or may not opt for accreditation. There are many advantages of accreditation on the other hand if a laboratory is confident about the results produced by them without accreditation and their results are acceptable by the various stakeholders, users, policymakers then the lab can operate without accreditation. It has been noticed that accredited labs have always an edge over non-accredited labs, therefore, general labs may opt for the accreditation for their acceptability at the global level.

KEY WORDS : Accredited laboratory, Non-accredited laboratory, Sampling, Assessment, Verification, Quality Management System, Technical competence

INTRODUCTION

The testing of environmental parameters is very essential and there are many labs available in the country for the testing of soil and water. The results which are produced by the laboratory are used for decision-making from various angles. Sometimes farmer may use the results of soil for farming the various crops (Dunbar *et al.*, 2017; Guzel and Guner, 2009). Similarly, water samples can be tested by the laboratory and their results can be used for industrial as well as domestic use. There are various

standards available based on these standards the ranges for various parameters are given. The test results on which various strategic decisions are taken by the government or individual organization should be reliable. The reliability of the results always needs to be assured and these results should be comparable whenever they are tested by some other laboratory at different times (Kaushik *et al.,* 2009). In India there are two types of options are available for testing the various parameters of the environment like air pollution, soil and water, accredited laboratory and non-accredited laboratory (Verstraete *et al.,* 1998; Middlebrook, (2017)

The concept of the accredited and non-accredited laboratory is available in the government as well as non-governmental systems. The governmental system means laboratory which is working under the organization of government, like ministries, boards,and government undertakings, etc. Similarly, in the non-governmental system, there are many organizations like laboratory, laboratories of some industry or laboratory of some NGO etc. In governmental as well as the non-governmental system there are accredited and non-accredited laboratories are available. In the governmental system, there are ministries and boards which are having testing laboratories but only very few laboratories are accredited, whereas in the recent past the no. of accredited laboratories is increasing slowly (Cortez, (1999); Wadhwa *et al.,* 2012). On the other hand, in the private system, the accredited and non-accredited laboratories are available. In a certain organization,some laboratories testing environmental parameters, and they are not accredited. Other examples can be a partially accredited laboratory, the partial accredited means that the laboratory is accredited for the testing of other parameters like mechanical testing food testing but not accredited for air, water, and soil testing. In this article, we have reported, comparative analysis of results by an accredited and nonaccredited laboratory for water and soil samples

METHODOLOGY

Collection of water and soil samples

The soil and construction water samples were collected as per the guidelines of IS 3025. Fifteen soil samples were collected from village Bhaira Bakipur, Sonepat, Haryana, samples were collected within the periphery of one kilometer (Dimri *et al.,* 2018; Chatterjee *et al.,* 2019). Coded samples send to the accredited and non-accredited laboratory. Fifteen samples of water used for construction purposes were collected from the village, Dostpur Mangroli. All coded samples were given to the accredited and non-accredited laboratory.

Method for the analysis of soil sample

All soil samples were analyzed for pH value and Water-soluble Sulphate using IS methodology.

Method for the analysis of water sample

For water samples various parameter such as pH Value @ 25.0 °C, Chloride as Cl, (mg/l), Organic Impurities determined at 105°C (mg/l), Inorganic Impurities determined at 105°C, (mg/l), Total suspended solids determine at 105 °C, ml of 0.02N, NaOH used for 100 ml Water(Acidity), ml of 0.02N, H_2SO_4 used for 100 ml Water (Alkalinity), Sulphates as SO_4(mg/l). IS Standard methodology have been used for the analysis (IS 3025)

RESULTS

The results of comparative analysis of results by Accredited and Non accredited laboratories for water and soil samples are as follows:

The difference in the results of accredited labs and non^{-1} ccredited labs is found by the difference between the value of (accredited lab-value of non-accredited lab) sample wise.

For soil sample 1 to 15, pH value (6.36-7.48=**-1.12**, 7.42-6.68=**0.74**, 6.61-7.51=**-0.9**, 7.05-7.68=**-0.63**, 6.88-7.54=**-0.66**, 7.12-7.89=**-0.77**, 6.90-7.66=**-0.76**, 7.20-7.67=**-0.47**, 6.85-7.81=**-0.96**, 6.65-7.69=**-1.04**, 7.08-7.85=**-0.77**,7.09-7.90=**-0.81**, 6.98-7.66=**-0.68**, 6.90-7.71=**-0.81**, 6.76-7.56=**-0.80**)

Soil samples 1 to 15, Water soluble Sulphate, as SO4 % (0.41%-0.85%=**-0.44%**,0.04%-0.68%=**-0.64%,** 0.06%-0.65%=**-0.59%,** 0.06%-0.78%=**-0.72%,**0.08%-0.66%=**-0.58%,** 0.06%-0.61%=**-0.55%,** 0.07%-0.66%=**-0.59%,**0.06%-0.64%=**-0.58%,**0.05%-0.60%=**-0.55%,**0.07%-0.56%=**-0.49%,**0.08%-0.60%=**-.52%,**0.07%-0.57%=**-0.50%,**0.04%-0.61%=**-0.57%,**0.06%-0.55%=**-049%,** 0.08%-0.71%=**-0.63%)**

Construction water sample 1 to 15**,** pH Value @ 25.0 °C**,IS 3025 (Part 11):1983**, (7.2-6.2=**1.0**,8.2-5.8=**2.4,**8.3-6.1=**2.2,**7.5-6.3=**1.2,**7.4-6.1=**1.3,**7.4-6.2=**1.2,**7.9-6.3=**1.6,**7.6-6.3=**1.3,**7.3-6.4=**0.9,**7.8-6.4=**1.4,**7.6-6.5=**1.1,**7.6-6.4=**1.2,**7.3-6.1=**1.2,**7.2-6.3=**0.9,**7.6-6.3=**1.3,)**

Construction water sample 1 to 15**,** Chloride as Cl, (mg/l) **IS 3025 (Part 32):1988 ,** (33.8-78.4=**-44.6,** 58-

58.5=**-0.5,** 111.1-120.8=**-9.7,** 14.5-90.7=**-76.2,** 14.5-120.8=**-106.3,** 97-81=**16,** 67-88=**-21,** 33.4-54.3=**-20.9,** 35.7-66.2=**-30.5,** 102.4-131.2=**-28.8,** 12.3-76.3=**-64,** 45-70.3=**-25.3,** 89.4-121.2=**-31.8,** 76-94=**-18,** 75-98.3=**-23.3)**

Construction water sample 1 to 15, Organic Impurities determined at 105°C, (mg/l),**IS : 3025 (Part 18) :1984,** (68-120=**-52,**88-60=**28,** 102-90=**12,** 48-106=**-58,** 24-90=**-66,** 95-72=**23,** 120-153=**-33,** 67-78=**-11,** 61-90=**-29,** 98-87=**11,** 55-97=**-42,** 83-76=**7,** 78-87=**-9,** 73-45=**28,** 79-135=**-56)**

Construction water sample 1 to 15, Inorganic Impurities determined at temperature 105 °C, (mg/l), **3025 (Part 18):1984, (** 68-120=**-52,** 88-60=**28,** 102-90=**12,** 48-106=**-58,** 44-120=**-76,** 407-342=**65,** 398-320=**78,** 234-300=**-66,** 175-375=**-200,** 345-223=**122,** 98-145=**-47,** 325-289=**36,** 311-275=**36,** 312-267=**45,** 390-243=**147)**

Construction water sample 1 to 15, Total suspended solids determined 105°C, **IS 3025 (Part 17):1984, (**4-60=**-56,** 2-140=**-138,** 2-80=**-78,** 7-56=**-49,** 2-80=**-78,** 20-98=**-78,** 6-92=**-86,** 4-56=**-52,** 8-45=**-37,** 4-56=**-52,** 5-48=**-43,** 4-34=**-30,** 3-32=**-29,** 3-89=**-86,** 5-112=**-107)**

Construction water sample 1 to 15, ml of 0.02N, NaOH used for 100ml Water (Acidity), **IS 3025 (Part 22):1986, (**<0.47-<1.2=**-0.73,** <0.1-<4.8=**-4.7,** <0.1-<3.4=**-3.3,** <0.27-<3.2=**-2.93,** <0.2-<3.4=**-3.2,** <0.3-<3.5=**3.2,** <0.3-<2.5=**-2.2,** <0.2-<3.4=**3.2,** <0.15-<1.9=**-1.75,** <0.2-<3.0=**-2.8,** <0.17-<3.5=**-3.33,** <0.2-<2.7=**-2.5,** <0.1-<2.7=**-2.6,** <0.2-<3.2=**-3.0,** <0.2-<3.4=**3.2)**

Construction water sample 1 to 15, ml of 0.02N, H2SO4used for 100ml Water (Alkalinity), **using IS 3025 (Part 23):1986, (**5.3-15.3=**-10.0,** 18.8-10.9=**7.9,** 24.7-6.4=**18.3,** 2.7-12=**-9.3,** 2.4-6.4=**-4.0,** 20.4-15.9=**4.5,** 16.7-11.2=**5.5,** 12.3-13.7=**-1.4,** 7.2-11.4=**-4.2,** 22.3-14.3=**8,** 2.5-9.4=**-6.9,** 15.8-23.9=**-8.1,** 20.3-15.3=**5,** 15.3-11.2=**4.1,** 20.3-10.9=**9.4)**

Construction water sample 1 to 15, Sulphates as SO4(mg/l), **IS 3025 (Part 24):1986 (Gravimetric Method), (** 21-45=**-24,** 24.6-98.6=**-74,** 55.2-76=**-20.8,** 30.5-60.6=**-30.1,** 11-76=**-65,** 45.0-102.4=**-57.4,** 35.2-63.4=**-28.2,** 14.2-63.4=**-49.2,** 18-39=**-21,** 48.4-69.8=**-21.4,** 45-64.3=**-19.3,** 33.4-63.5=**-30.1,** 35.4-59.7=**-24.3,** 23.4-77.6=**-54.2,** 29.3-112.8=**-83.5)**

DISCUSSION AND CONCLUSION

The difference can be seen from the comparison of the soil and water samples. In the case of soil it has been observed that pH and Water-soluble Sulphate, as SO4 %, the difference in the results is comparatively high. The competence of the non-accredited laboratory needs to be strengthened for various quality components laid down in the standard (ISO/IEC 17025:2017; ISO/IEC 17000:2004). The range of difference in the case of pH measurement is -1.12 to 0.76 and for Water-soluble Sulphate, as SO4 % it is 0.44% to 0.72%which indicatesthe requirement of accreditation and assessment system. Similarly, for the water sample, the difference between the measurement values of the accredited and non-accredited laboratory is very high. The results produced by the accredited and non-accredited laboratory are not comparable and the reason for the huge difference may be the accreditation of the laboratory. In the case of accreditation, the laboratory needs to demonstrate competence in the presence of the assessor deputed by the accreditation body and competence can only be established with the help of traceable reference standards, qualified and trained personnel, controlled accommodation environmental conditions. Also, the laboratory needs to maintain the quality system as per the ISO/IEC 17025:2017. The accredited laboratory has to maintain the quality of their results with the help of retesting, replicate testing, PT/ILC results for the accredited scope. The accreditation is given only for a particular cycle of two years and the laboratory has to face assessment before the expiry of the accreditation cycle. Whereas there are no such requirements needed in the case of non-accredited laboratories. In the case of the accredited laboratory if any of the customersare not satisfied with the results of the laboratorythey can approach another accredited laboratory and results can be compared. Also, there is a control mechanism by the accreditation body over the accredited laboratory. The accreditation body may plan an unannounced visit to verify the quality of results and overall operation of the laboratory. In the case of a non-accredited laboratory, there is no compulsion of assessment, quality control activity,and competence of the personnel therefore most of the time the results produced by the non-accredited laboratory are not comparable with the accredited laboratory. The results produced by the non-accredited laboratory cannot be believed and this is evident from the comparison of the results of soil and water. Still there are some very good laboratories from the government as well as privates' sectors that are not accredited but the results produced by them are

comparable to the accredited labs. But the no. of these labs is very less. Therefore, it is always recommended that the other benefits of accreditation can be benefited by the labs which are producing at par results as compared to accredited labs. Still, various departments in India are accepting the results of non-accredited laboratories but the scenario is changing slowly and most of the stakeholders and interested parties are asking for accreditation. In the future, by general demand, accreditation can be the required parameter but no compulsory/mandatory for the laboratories.

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