Determination of Food Adulteration by Monopole Antenna

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***Abstract*--In food adulteration, the presence of other substances is to be detected in liquid food and for this purpose a monopole antenna is investigated in this paper. The related antenna design and variation in resonant frequency of monopole antenna in different liquid was also discussed in this paper.**

***Index Terms*—monopole antenna, return loss**

I. Introduction

Now a days, the impurity in food is a common thing and these impurities are detected by many methods but this paper try to sense these impurities by a monopole antenna [1].The basic goal behind the food Adulteration by antenna is to sense the impurities or other substances in the available liquid food, and for this purpose a highly sensitive antenna is to be needed. This research investigated such type of monopole antenna for this job.

II. Procedure

Basically, this method is based on the variation in resonant frequency of monopole antenna with different liquid. In this method, first of all, the resonant frequency of monopole antenna in pure liquid is measured again and again until it gives the same result after resonant frequency of monopole antenna in impure liquid is also measured. Eventually, the change in the resonant frequency of monopole antenna is considered for observation [2], if the resonant frequency of monopole antenna is varied in case of impure liquid then some other substances or impurities is present in there, which are captured by monopole antenna and show change in resonant frequency [3]. One shortcoming of this method is that it is a quality test and doesn't give the information about quantity of substances which are added in liquid.

III. Antenna Design for Food Adulteration

For food adulteration by antenna, there is need of an antenna which should have a sharp single band response [4], so the variation in return loss i.e. resonant frequency of antenna can easily observed. Although microstrip antenna can also used for this method but here a monopole antenna of 0.01 mm diameter (copper wire) are designed for frequency range of 1 GHz. The length of monopole is calculated by "λ/4" and ground plane of size 7.5cm×7.5cm is being used (as per designing parameter of monopole) [5]. All the lengths and current distribution are shown in the Fig. 1 as below.

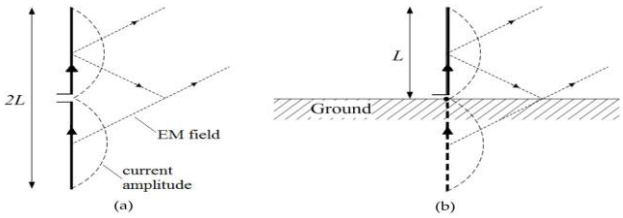


Figure 1. Lengths and current distribution of monopole antenna.

$$I(z) = I_o \sin\left[\frac{2\pi}{\lambda}\left(\frac{L}{2} - |z|\right)\right]$$

IV. Measurement

All the measurement has been done by FS-315 spectrum analyzer and readings are taken at minimum hold condition as well as constant condition of liquids. The typical monopole antenna in testing jar for food adulteration is shown in Fig. 2.

Manuscript received October 23, 2013; revised December 3, 2013

doi: 10.12720/ijeee.1.4.252-255

Figure 2. The typical fabricated monopole antenna in testing jar.

V. Results and Discussion

As discussed above, the whole procedure of food adulteration is moving around the difference of resonant frequency of monopole antenna in absences of other substances and present of the other substances. As far as the designed monopole antenna is concerned, it successfully works at 1GHz according to the Fig. 3. Now adulteration of each liquid will discussed one by one.

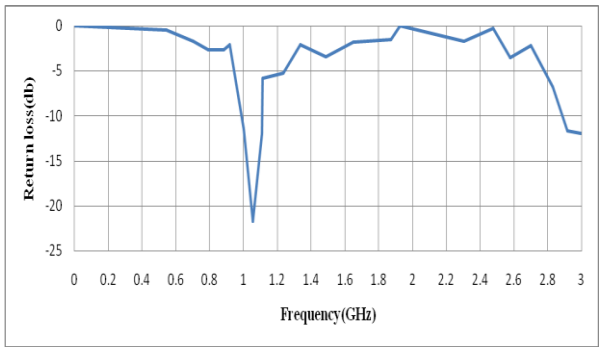
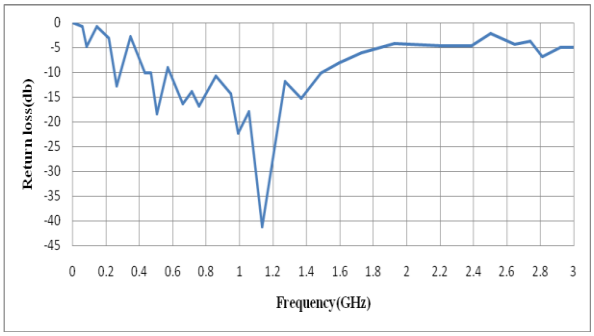
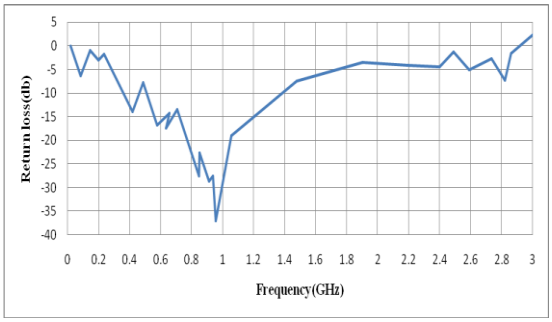


Figure 3. Performance of monopole antenna.

In case of water adulteration, the resonant frequency of monopole antenna is 1.134 GHz in pure water (as shown in Fig. 4) but as far as the salt is added with water and solution kept in constant condition, the resonant frequency of monopole antenna became changed to 0.954 GHz which shows some other substance is added with water that changes the resonant frequency of monopole antenna.



(a)



(b)

Figure 4. Determination of water adulteration by monopole antenna. (a) With pure water (b) With Salt.

In Fig. 5, Fig. 6, and Fig. 7) the monopole antenna shows it's resonant frequency is 0.564 GHz in pure milk but this resonant frequency of monopole antenna became change with water and it became 0.57 GHz. Here another milk is tested which are manufactured by (caco3+surf+milk accense), in this artificial milk the resonant frequency monopole antenna 0.570GHz. Which are totally different with pure milk and shows the impurity in milk.

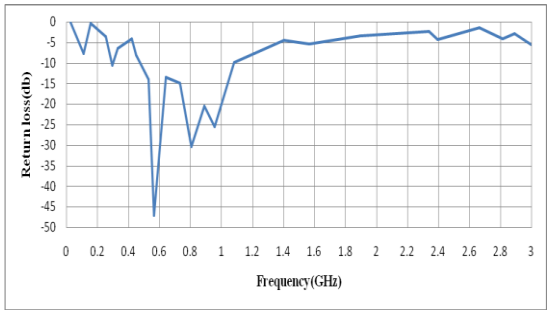


Figure 5. Monopole antenna with pure milk.

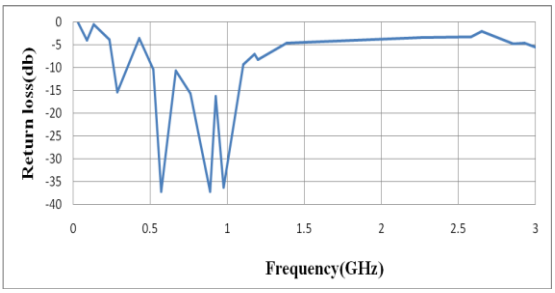


Figure 6. Monopole antenna with (Milk+water).

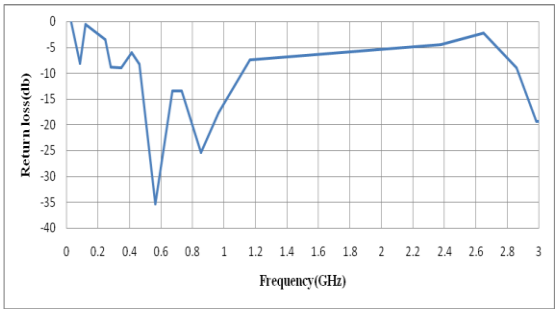


Figure 7. Monopole antenna with artificial Milk.

Now another general thing is taken for testing that is mustard oil. In case of pure mustard oil, the resonant frequency of monopole antenna is 0.732 GHz, after that another form of mustard oil is taken which are impure and tested in spectrum analyzer which shows the different resonant frequency of monopole antenna i.e.0.75 GHz (shown in Fig. 8, Fig. 9).

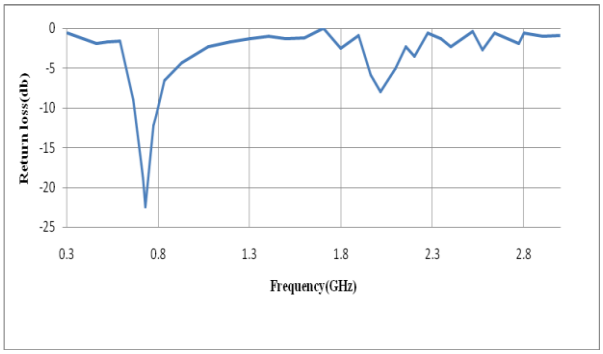


Figure 8. Monopole antenna with pure mustard oil.

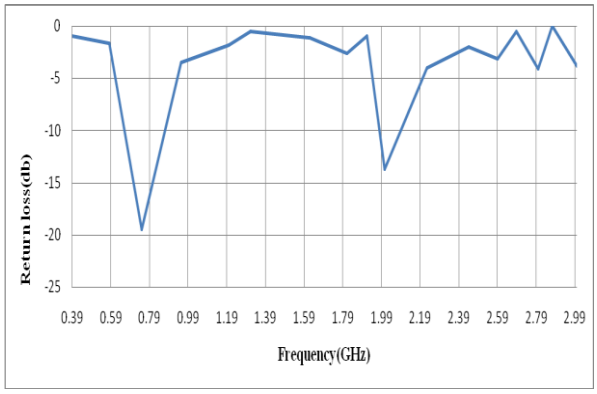


Figure 9. Monopole antenna with impure mustered oil.

In case of diesel adulteration, there is dual band response shown by monopole antenna (as shown in Fig. 10 and Fig. 11) but as far as the impurities is added with this diesel the resonant frequency of monopole antenna became changed (as shown in results) which shows the some other liquid is added with this diesel.

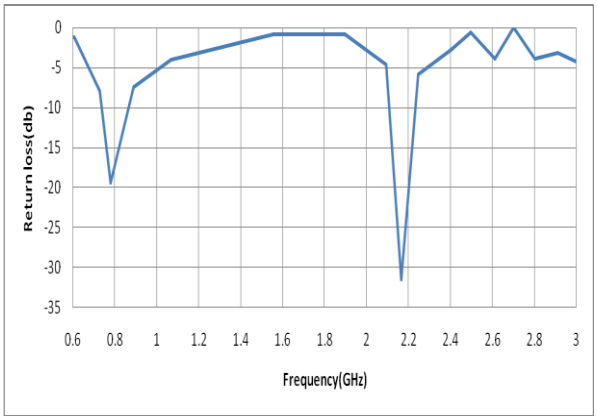


Figure 10. Monopole antenna with pure diesel.

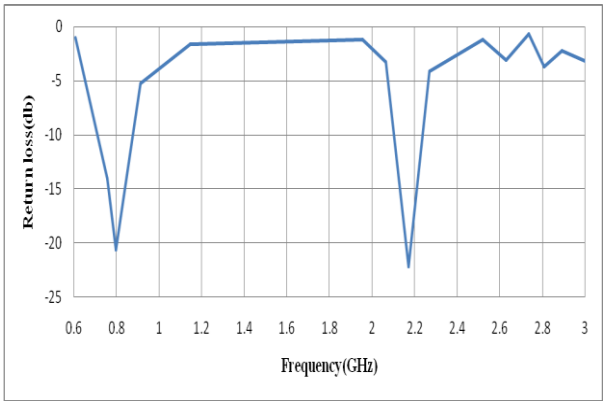


Figure 11. Monopole antenna with impure diesel.

All the liquids material, which are use for adulteration are taken from general available source.

All results have summarized in following table.

TABLE I. RESONANT FREQUENCY OF DIFFERENT LIQUIDS

	Liquid	Pure liquid	Impure liquid	Difference
1.	Water	1.134	0.954	180 MHz
2.	Milk	0.564	0.57	06 MHz
3.	Mustered oil	0.732	0.75	18 MHz
4.	Diesel oil	0.78, 2.166	0.798, 2.172	18.6 MHz

VI. CONCLUSION AND FUTURE SCOPE

From all the adulteration of different liquids by monopole antenna, this paper founds the satisfactory results. In future, this work can be carried from other sensitive antenna and get better results to detect the impurity in such things. and return loss from different liquids shown in different figure shown above this will definitely help science to detect the impurity in the fluids, impurity in the oils can also be find out above in Fig. 8, Fig. 9, Fig. 10, and Fig. 11, this can be very good research for the impurity these days are mixing in different fluids and human can be save from different hazards.

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