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Fake Pill Detection Using Quadrupole Nuclear Resonance

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Abstract: *Analgesia, one of the components of triad of anaesthesia, has now extended to relief of postoperative pain, chronic pain and cancer pain. The spinal cord has taken the center stage in analgesia practice and Spinal anaesthesia is the commo The production and sale of counterfeit and substandard pharmaceutical products, such as essential medicines, is an important global public health problem. Our method is based on applying Nuclear Quadrupole Resonance (NQR) spectroscopy to authenticate the contents of medicine packets. NQR is a non-invasive, non-destructive, and quantitative radio frequency (RF) spectroscopic technique. It is sensitive to subtle features of the solid-state chemical environment and thus generates unique chemical fingerprints that are intrinsically difficult to replicate. By measuring such spectra, we can readily identify many kinds of drugs prepared in slightly different ways-say tablets containing different inactive ingredients or produced using machines that apply different compacting pressures.*

Key Word: *Nuclear quadrupole resonance,NQR spectrometer, transmitter, receiver, duplexer and coil and label reader.*

I.INTRODUCTION

A **counterfeit medication** or a counterfeit drug is a medication or pharmaceutical product which is produced and sold with the intention to imitate the origin drug's effectiveness.

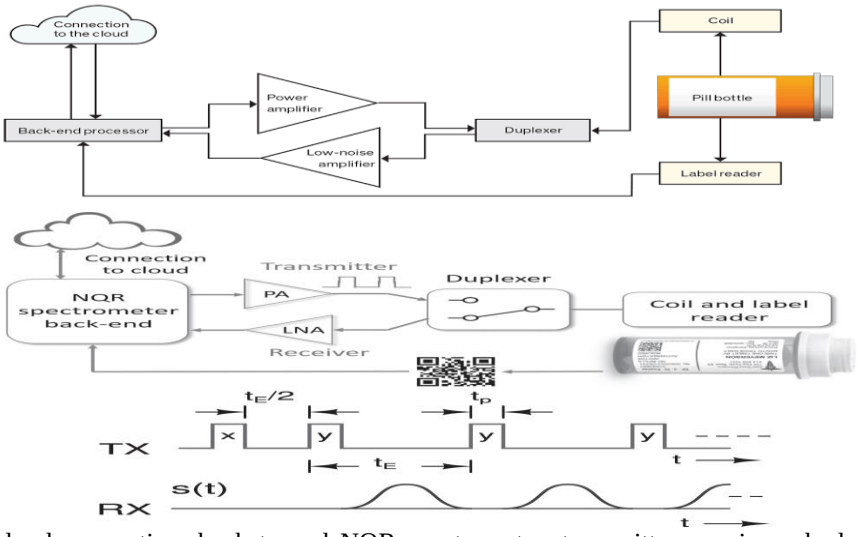
A counterfeit drug may contain inappropriate quantities of active ingredients which may be improperly processed within the body may contain ingredients that are not on the label or may be supplied with fake packaging and labeling.

Antibiotics with insufficient quantities of an active ingredient add to the problem of antibiotic resistance.

Counterfeiting drugs is a major problem in both developed and developing countries. It is prevalent in countries where drug regulation and enforcement are weak.

As these drugs have different concentrations or kinds of active ingredients, they may have differences in quality and efficiency and also may not be safe to use. For example, in one case, addition of diethylene glycol in counterfeit medicines led to death. Diethylene glycol can also lead to disorders in central nervous system, liver, and kidney failure.

II.CONSTRUCTION



It consists of cloud connection, back to end NQR spectrometer, transmitter, receiver, duplexer and coil and label reader.Prototype NQR equipment includes six fundamental blocks, including one designed for reading the label on a pill bottle. The back end controls the excitation pulses and converts the amplified output of the coil sensor to digital form for further analysis, which is performed elsewhere through a connection to the Internet.

III.WORKING PRINCIPLE

Four Poles: Nuclear quadrupole resonance requires an atomic nucleus with a non-spherical distribution of positive electric charge [left], which creates an electric quadrupole moment. The word quadrupole refers to the four electric poles that produce an equivalent non spherical charge distribution when added to a set of spherically distributed charges.

Nuclei with quadrupole moments can occupy only certain distinct energy levels. Those levels are determined by the interaction between a nucleus's quadrupole moment and the charge distribution of the electrons that surround the nucleus. That charge distribution is in turn determined by the chemical environment the nucleus finds itself in. So by measuring the energy levels in the nucleus—or more accurately, by measuring the differences between energy levels as the nucleus shifts from one level to another—you can infer what the chemical environment is.

NQR doesn't require that the sample be placed in a strong magnetic field. So there's no need for an expensive superconducting magnet of the type found in MRI scanners. All you really need is a coil of wire and some suitable electronics for generating the appropriate radio-frequency excitations and measuring the sample's response. The excitation consists of one or more RF pulses generated by a power amplifier producing at most a few watts. These pulses are applied to the sample by a transmitter coil that generates an oscillating magnetic field. The field gives rise to oscillations within some of the atomic nuclei in the sample; the oscillations can be measured by a receiving coil attached to a suitable low noise RF amplifier. And you can simplify it further by including a switch that allows you to use the same physical coil for both transmission and reception.

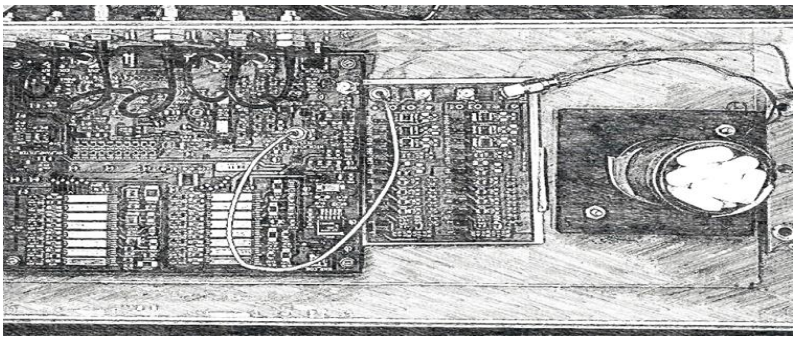
IV.ADVANTAGES

- Non-invasive and non-destructive
- Can be used on packaged medicines and consignments in parcels
- Can detect counterfeit as well as substandard degraded drugs
- Can determine material properties such as form, physical processing and other effects such as ageing
- Adaptable to mobile operation
- Simple Yes/ No response

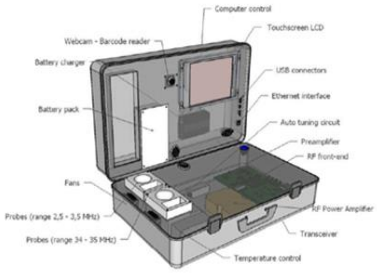
V.COSTING

- CLASS E POWER AMPLIFIER: ISO-14443A
  - COST: 21000/-
- LOW NOISE POWER AMPLIFIER: ISO-9001:2015/AS9120B
  - COST:4000/-
- BACK TO END PROCESSOR: ISO9001:2015
  - COST: 2 LAKHS
- COIL AND LABEL READER:ISO/IEC/15416
  - 56000/-
- TOTAL:281000/-

VI.2-D MODEL



3-D Model



Prototype portable screening device
for packaged medicines
Mounted in a rugged carry case
Dimensions: 33cm x 53cm x 19cm
Weight: ~ 8 kg
Battery or mains powered

VII.TESING AND DEVELOPMENT

- **Electronic Equipment Testing**

Electronic devices such as amplifiers, duplexer, and back to end processor are tested

The equipment doesn't detect liquid drugs so more development should be done in order to make the device more efficient.

VIII.CONCLUSION

We readily admit that NQR has some special challenges. The biggest are its inherently low signal levels and poor signal-to-noise ratios. Those same issues are what stymied earlier applications of NQR to explosives detection. A related problem is external RF interference, created, say, by an AM radio station or by a noisy switching power supply in nearby equipment. And finally, the NQR sample coil is normally attached to capacitors in what's known as a tuned circuit, so that power can be applied to it effectively during transmission and to ensure that it is sensitive to the appropriate spectral band during the reception interval. Tuning the coil manually to measure each new NQR spectral line would be a difficult and time-consuming process.

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