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Review

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Percentage Discrepancies Assessment Between Measured and Calculated Behaviour of Percent Depth Dose in External Beam Radiotherapy

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(received October 24, 2012; revised February 25, 2013; accepted April 19, 2013)

Abstract. The aim of this study was to calculate percentage discrepancies (PD) of the measured and calculated percentage depth doses (PDDs) values. The 6 MV photon beam produced by the Varian linear accelerator 2100 C/D was used in this study. PDDs, tissue maximum ratios (TMR) and phantom scatter factor (S_p) were measured using the PTW 31006 ionisation chamber in water phantom. PD between PDD values of the measured and calculated was ranging between 0.30% and 2.38%. Percentage discrepancies were also found higher against 20 cm depth in water for (20×20) cm^2 field size. These discrepancies should be taken into account, while delivering any medical dose in radiation therapy centers.

Keywords: percentage depth dose, percentage discrepancies, ionisation chamber

Pak. j. sci. ind. res. Ser. A: phys. sci. 2014 **57** (2) 63-69

Dynamics of Electron Concentration for Ionospheric Region of Pakistan

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(received February 13, 2013; revised June 2, 2013; accepted June 19, 2013)

Abstract. The fluctuating dynamics of electron density is highly dependent on altitude from center of the earth. The long distance communication *via* F_2 layer is the best suited through refraction of radio wave in the range of 3-30 MHz. In present study, the F_2 layer hourly data for 2006, recorded at SUPARCO Islamabad Ionosphere Station (SIIS), located at latitude 33.75°N and longitude 72.87°E have been considered. The recorded ordinary wave frequency has been utilised to compute relationship with variation in electron concentration. The estimation of variability is determined for forecast and modeling purposes. The standard techniques have been performed such as regression, stochastic analysis and parameter estimation using data obtained from source. Predicting sky wave propagation at Pakistan ionospheric region has been presented.

Keywords: ionosphere, ordinary wave frequency, total electron count, electron density, temporal variations

Pak. j. sci. ind. res. Ser. A: phys. sci. 2014 **57** (2) 70-73

Extraction, Purification and Characterisation of Nutraceutical Grade Fulvic Acid from Lignite Coal of Lakhra-Jamshoro, Pakistan

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Abstract. Fulvic acid, a water-soluble substance was extracted from Pakistani coal. Pure fulvic acid fraction was recovered before the start of its decomposition. The mechanism forming the precipitates was based on re-crystallisation of fulvic acid in water (2.45% yields). Fourier transform infra red (FT-IR) as well uv-vis spectroscopic techniques were successfully employed to characterise and confirm the obtained crystals as fulvic acid. It was observed that the spectral features obtained from FT-IR and uv-vis spectroscopy were similar to those reported for fulvic acid fractions from other sources. Recovered pure fraction of fulvic acid was characterised by the suggested simple techniques.

Keywords: lignite coal, extraction, purification, fulvic acid, characterisation

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Evaluation of Free Radical Scavenging Activity of Tea Infusion of Commercial Tea Products Available in UAE

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(received September 25, 2012; revised November 19, 2012; accepted December 5, 2012)

Abstract. In the present study, twenty four commercial tea samples were assayed to determine their free radical scavenging activity and polyphenolic contents based on the brewing/infusing period. Tea samples were infused/brewed in 200 mL boiled water at 120 °C for 1, 2 and 5 min, respectively. The radical scavenging activities of tea infusion/brewing were measured using 1,1-diphenyl-2-picrylhydrazyl radical (DPPH) assay method. The results were ranged from 67.81-90.51% for black tea bags, 90.37-94.51% for green tea bags, 24.66-92.25% for black tea powder, 16.08-93.06% for green tea powder and 32.90-45.54% for Camomile herbal infusion. The results showed that 1 or 2 min black tea bags infusion exhibited highest radical scavenging activity than 5 min infusion. Antioxidant activities of tea powders were variable with the amount of tea powder. It was observed that antioxidant activity increased with increasing boiling time for smaller amount of sample. In contrary, shorter boiling time was better for larger amount of sample. The polyphenol contents of tea infusion were determined and the results were expressed as milligram quercetin equivalent/200 mL of tea infusion. The polyphenol content was increased with increased brewing period. In contrary, brewing for longer time rendered extract less antiradical activity. This study suggests that infusing tea bag for 1 or 2 min is sufficient for getting infusion with maximum radical scavenging activity and in case of tea powder, shorter boiling time is better for larger amount of powder or small amount of powder should be boiled for minimum 5 min for rendering extract with maximum radical scavenging activity.

Keywords: tea bag, tea powder, antioxidants, polyphenols, 1,1-diphenyl-2-picrylhydrazyl radical

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Quality of Wastewater Used for Conventional Irrigation in the Vicinity of Lahore and its Impact on Receiving Soils and Vegetables

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(received March 30, 2012; revised July 16, 2013; accepted August 5, 2013)

Abstract. The quality of wastewater was evaluated from Rohi Nullah, Lahore, Pakistan, for one year (2008-2009) from those points where it is used for irrigation of crops on both sides of Nullah. The quality of wastewater was evaluated for pollution load including pH, sulphide, phenol, methylene blue active substances, chemical oxygen demand (COD), biochemical oxygen demand (BOD), irrigation quality (electric conductivity, total dissolved solids, total suspended solids, sodium adsorption ratio, residual sodium carbonate and chlorides) nutritional value (total nitrogen, total phosphorus and total potassium) and for metal concentration. The metals analysed were cadmium, nickel, chromium, zinc, manganese, cobalt and copper. With respect to pollution load BOD, COD and sulphide concentration was above the National Environmental Quality Standard (NEQS) limit. Nitrogen and phosphorus were contained at levels of concern in wastewater but the level of potassium was below crop requirements. The concentration of nickel, chromium, manganese and copper was above the FAO standards, while the concentration of cadmium, zinc and cobalt fell within FAO standards. Considering NEQS standards, the metals concentration was within limits. Temporal variations were prominent in some parameters and mostly higher values were observed in summer and lower in winter season. There was accumulation of heavy metals in soils receiving wastewater for irrigation. The metal contents in soils follow the order Mn> Co> Zn> Cr > Ni > Cu > Cd. It was observed that the concentration of all studied toxic metals in edible part of the vegetables was above the critical level. Finally, it was concluded that the practice of using wastewater in irrigation for growing vegetables and other crops is non-sustainable.

Keywords: wastewater, irrigation quality, COD, BOD, SAR, metal ions

Pak. j. sci. ind. res. Ser. A: phys. sci. 2014 **57**(2) 95-102

Noise Pollution - A Case Study of Rawalpindi City, Pakistan

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(received February 1, 2013; revised May 2, 2013; accepted June 26, 2013)

Abstract. In this study, noise level was measured during day time in 88 different locations of the Rawalpindi city, Pakistan, which included roads, choaks, residential areas, educational institutions, hospitals, railway stations,airport, bus stands, shopping plazas and markets. The noise measurements were performed with a calibrated sound level meter. Study finds that overall minimum and maximum noise levels for the main roads and choaks were 55.4 and 101.9 dB(A), for residential areas 38.80 and 91.0 dB(A), for educational institutions 60.0 and 94.4 dB(A), for hospital 45.1 and 84.4 dB(A), for railway stations, airport, bus stands 59.2 and 102.5 dB(A) and for shopping plazas, markets 53.8 and 81.2 dB(A), respectively. The result of the study revealed that the noise level surpassed the prescribed NEQS limits as well as WHO guideline values for noise in specific environments in all areas under study, which can cause harmful effects on human health, animals and the environment.

Keywords: noise pollution, sound level, environment

Pak. j. sci. ind. res. Ser. A: phys. sci. 2014 **57** (2) 103-108

A Study on Noise in Indian Banks: An Impugnation in the Developing Countries

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(received April 9, 2012; revised March 27, 2013; accepted April 3, 2013)

Abstract. In the present study, noise levels were monitored in twenty one different banks of the Cuttack, the largest commercial city of the State Odisha, India, in the months of January to April, 2011 during two specified times (10 a.m.-1 p.m. and 1-4 p.m.). Different noise descriptors such as L_{10}, L_{50}, L_{90}, L_{eq}, NPL (noise pollution level), NC (noise climate) etc., were analysed to infer the extent of noise pollution in the investigated commercial banks of Cuttack. The noise levels in different banks ranged from 51.1 to 90.5 dB and from 51.4 to 91.1 dB during 10 a.m.-1 p.m. and 1 -4 p.m., respectively. Similarly, L_{eq} ranged from 71.5 to 82.1 and 67.4 to 72.2 dB and NPL ranged from 90.6 to 105.5 dB and 81.6 to 100.8 dB during 10 a.m.-1 p.m. and 1-4 p.m., respectively, which is more than permissible limit i.e., 50 dB (as prescribed in USA). T-test was also computed for all the 21 banks to infer the existence and statistical significance of the variations in noise levels.

Keywords: office noise, bank, noise distraction, noise descriptors, Cuttack

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Review

Advances in Nanotechnology: Influence on Biomolecular Detection Sensors

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(received April 6, 2012; revised February 8, 2013; accepted February 26, 2013)

Abstract. Nanodevices and biomolecules have incredibly strong correspondence in terms of size and physical properties. In this review, three major types of nanodevices, namely cantilevers, nanowires and carbon nanotubes, have been discussed and how they have resulted in new sensor designs or helped push the limits of detection in existing schemes. After brief overview of each type and the ways it could be used in biosensing, recent research efforts are presented to emphasise the challenges and achievements in that particular category.

Keywords: nanobiosensors, biosensors, nanodevices, cantilevers, nanowires, carbon nanotubes