Short Communication

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Spectrophotometeric Determination of Metals in Pakistani and Foreign Brand Cigarette Tobacco

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Tobacco smoking and related uses are a major cause of various diseases in human beings (Bartecchi *et al* 1995; Philips 1996). A study on the nature and quantities of many elements present in tobacco leaves is important to the tobacco and health researchers (Sato *et al* 1977). During the last two decades, many researchers have used different techniques for the determination of inorganic constituents, particularly that of trace metals in tobacco of different brands of cigarettes of various countries (Abedinzadeh *et al* 1973; Ahmed *et el* 1979; Iskander 1985 a & b; Ricket *et al* 1994). In the present study forty-one various brands of cigarettes for Pakistan, USA, UK and Japan have been selected for the determination of iron, nickel and copper spectrophotometerically.

Tobacco of each cigarette of each brand was weighed and dissolved in an acid mixture containing 10ml of 65% HNO_3 and 4 ml of 60% $HClO_4$. Organic matter was decomposed and the metal ions were changed into their respective nitrates. The volume of the mixture was then made up to 25ml by adding deionized water. Dimethylglyoxime, diethyldithiocarbamate and ammonium thiocyanate were used to complex Ni, Cu and Fe respectively by using standard methods (Vogel 1996). The absorbance of the complexes formed were measured spectrophotometrically at 445, 435 and 480 nm for Ni, Cu and Fe respectively.

Table 1 shows the concentration of Fe, Ni and Cu in tobacco of forty-one brands of national and foreign cigarettes. The concentration range of Fe, Ni and Cu in different brands of to bacco of various countries is shown in Table 2.

In the regression analysis of data, each value represents an average of seven independent measurements. Statistical analysis shows that maximum concentration of Fe is present in Pakistani cigarettes and the least is observed in American brands. The concentration values of Fe in Pakistani and Japanese cigarettes are in close proximity (290.2 and 287.5 ppm respectively). The standard deviation in Pakistani brands is higher (34.1 ppm) indicating a large variation in concentration of iron from brand to brand. The sources of Fe in tobacco plants are numerous. One of the main source is the environ-

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Table 1
Concentration of Fe, Ni and Cu in various brands of cigarettes

Sample code* (Name)	Weight of tobacco per cigarette (g)	Concentration (ppm) Fe	Ni	Cu
P1	0.874	290.3	3.7	14.4
P2	0.998	336.1	3.7	14.9
P3	0.896	319.0	4.0	14.6
P4	0.812	279.2	3.9	14.2
P5	0.957	326.9	3.7	14.8
P6	0.776	255.8	3.7	13.8
P7	1.029	364.9	3.6	15.2
P8	0.795	263.0	3.6	14.1
P9	0.767	325.2	3.6	14.0
P10	0.874	285.2	3.6	14.5
P11	0.844	286.5	3.6	14.5
P12	0.748	248.8	3.6	13.9
P13	0.786	261.8	3.7	13.9
P14	0.814	275.1	3.7	14.8
P15	0.714	237.0	3.9	14.3
P16	0.850	287.3	3.6	14.7
P17	0.831	281.5	3.8	14.7
P18	0.799	263.8	3.3	14.4
P19	0.828	300.7	3.6	14.5
P20	0.956	330.9	3.6	14.5
P21	0.964	350.5	3.6	14.7
B1	0.722	292.9	3.2	13.7
B2	0.705	277.9	3.3	13.6
B3	0.845	349.2	3.9	14.5
B4	0.690	260.2	3.9	13.4
B5	0.696	261.5	3.6	13.5
B6	0.676	243.8	4.0	13.1
B7	0.698	261.2	4.3	13.5
B8	0.689	261.2	4.0	13.4
B9	0.708	283.3	3.4	13.6
A1	0.605	222.7	3.9	12.9
A2	0.706	297.7	4.1	13.6
A3	0.629	236.1	4.1	13.3
A4	0.615	228.9	4.0	13.9
A5	0551	215.3	3.9	12.5
A6	0.650	255.3	4.2	13.5
A7	0.655	262.8	4.0	13.3
A8	0.644	262.6	3.7	13.3
J1	0.644	277.8	3.9	13.1
J2	0.708	296.7	4.1	14.1
J3	0.697	289.1	3.9	13.6

*P, Pakistani; B, British; A, American; J, Japanese.

Table 2
Concentration range of Fe, Ni and Cu in (ppm) in various brands of cigarettes from different countries.

Country	Fe	Ni	Cu
Pakistan (P)	(237.0-364.9)±34.1	(3.3-4.0)±0.13	(13.8-15.2)±0.34
Britain (B)	(243.8-349.2)±28.7	(3.2-4.3)±0.32	(13.1-14.5)±0.34
America (A)	(215.3-297.7)±20.9	(3.7-4.2)±0.12	(12.5-13.9)±0.35
Japan (J)	(277.8-296.7)±6.8	(3.9-4.1)±0.06	(13.1-14.1)±0.30

mental transportation of Fe salts such as ferric oxides from various minerals, which are an integral part of many soil samples. Another major source is the fertilizers such as $Fe(SO_4)_2$ which has been used for many years as a treatment for Fe deficiency in plants and soils.

Statistical analysis for Ni shows that its concentration is greater (P=0.01) in American and Japanese cigarettes (4.0 ppm), while in Pakistani and British brands, the mean concentration is 3.7 ppm. The standard deviation for British brands is higher as compared to others, indicating fluctuation in terms of Ni concentration from brand to brand. The only source of Ni in tobacco plants is soil, the plants tend to strongly absorb Ni from the soil and accumulate it in the leaf (Bache *et al* 1985). Iskander (1985-a,b) also found 5.5 ppm Ni in Egyptian cigarettes where as foreign brands were found to contain 2.8-4.8 μg Ni per cigarette.

Statistical analysis data for Cu in cigarette from four different countries (Table 2) show that the mean concentration (14.4 ppm) in Pakistani cigarettes is higher (P=0.01) as compared to foreign brands (13.6 ppm).

The spectrophotometric determination of Fe, Ni and Cu in 41 brands of Pakistani and imported cigarettes reveals that the concentrations of these metals depends on different conditions, such as soil condition, fertilizer and sprays during the tobacco growth. However, Cigarette manufacturing companies could have a significant role in their concentration levels. The results obtained by this technique are in good agreement with the reported literature values (Abedinzadeh *et al* 1977).

Key words: Tobacco, Trace elements, Spectrophotometer.

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