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Nitrate and Nitrite accumulation in Tomato and Potato in Ardabil Province

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ABSTRACT
The research was conducted to determine the residual nitrite and nitrate on potatoes and tomatoes, two commercially important vegetables in Ardabil province. Samples of these plants were collected randomly from farms and wholesale markets in 10 day intervals at harvesting time in three sites (Ardabil, Parsabad and Meshkin Shahr) during 2004 and 2005. The samples were analyzed for residual nitrate and nitrite using spectroscopic method. The results revealed that in 10% of potato samples nitrate concentration was more than acceptable level (465 – 519.3 mg/kg fresh weight). Nitrite residue in potatoes ranged from 0.1 to 1.12 mg/kg. The nitrite and nitrate concentrations of 83.4% and 33% of tomato samples were lower than detecting limit of the methods. The amount of nitrate in tomato samples of Meshghin shahr was 20 fold lowers than Parsabads region that probably resulted from higher nitrogen fertilizers application in this region.

INTRODUCTION

Accumulated nitrate in plants related to plant species, season variation resulted from geographical situation, light intensity, temperature, amount of applied fertilizer and plant growth habit such as green house or field condition; and so availability of nitrate and other nutrients such as P, S, K, Fe, Mo, Ca, Mn and B in root zone. In fact this factors affect nitrate reductase enzyme activity (Carter and Bosma 1974). Also many plants predominance reduce nitrate in roots but some of them do it in shoot organse. For this reason we can detect more nitrate in several shoot organs of this plant relative to nitrate availability, plant species and growth stage. Nitrate accumulation in root increased with increasing temprature and so nitrate accumulation will inease by growth devalopment (marschner 1995). Nitrate accumulation in vegetables and fruits are hazarduce for human health. In this study oure efforts was to determine how is nitrate amount of potato and tomatoes that produce in Ardabil province.

MATERIAL and METHOD

We produced nitrate free potato and tomato for calibration of analytical instruments. Real potato samples were taken periodically (10 days interval) from wholesale markets of Ardabil and tomato from wholesale markets and farms at harvest time. Nitrate and nitrite were analyzed using standard spectroscopic method at 520 nm.

RESULTS and DISCUSSION

Only in 10% of potato samples (table 1) nitrate were higher than MRL (maximum residue limits). Based on Dedeh (2003) and Mare (2001) potato nitrate MRL is 250-300 mg /kg). Increasing fertilizers cost and attention to scientific plant production methods are the reasons for lowering nitrate rsidue in potat. Nitrite residue of potato samples was also lower.

Nitrate and nitrite residu of tomato were very lowe. There were no nitrite in 83.4 percent of samples and 33% of samples had no nitrate. Nitrate residue of regions was different each other. Meshkinshahr region had litle nitrate and its amount was 20 fold lower than Parsabads samples(Tab 2). This results show that in Parsabad region higher amounts of nitrogenous fertilizers are used.Christou et al (2003) found that in 10 Meditrranian regions tomato nitrate was between 0.003-0.17 percent of dry mass. Although this results showed that there is nitrit and nitrate residue lower than MRL, but we suggest that there is nesesity to determine chemical substances in food periodicaly all over the year.

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Table 1: Nitrite and nitrate amounts of potato samples and their daily intake if one 60kg body weight person feed one kg potato.

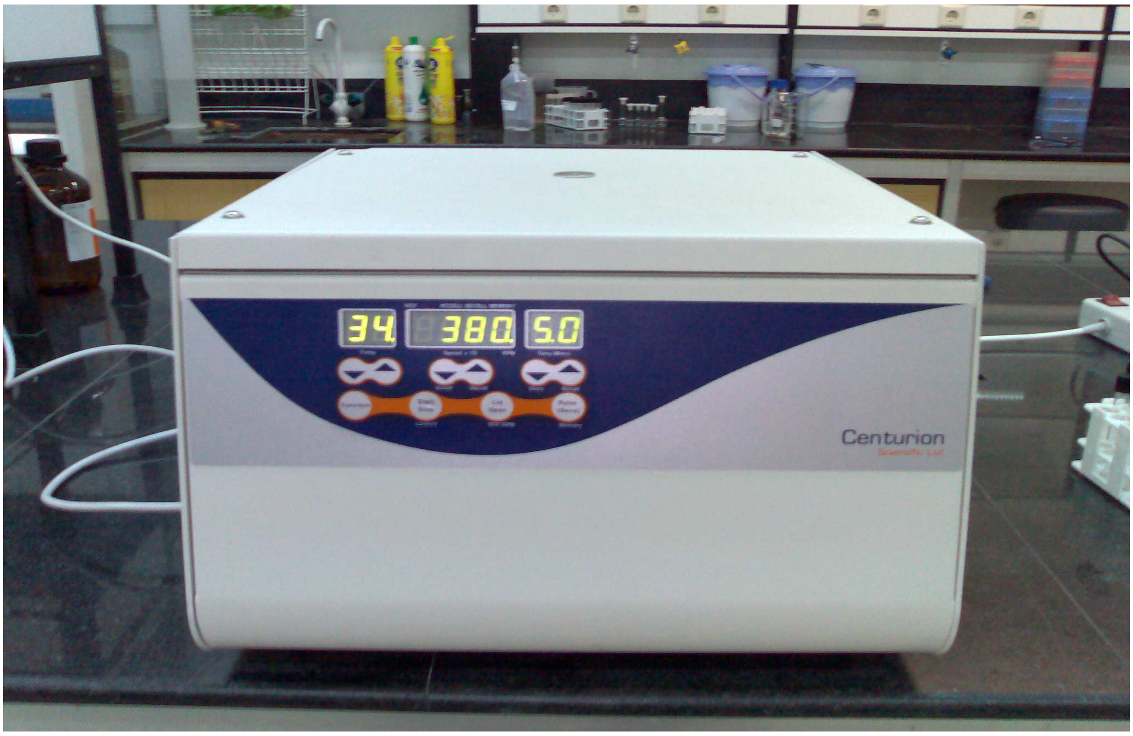
Potato sample	**NO_2^- (mg/Kg)**	**nitrite(mg / kg body weight)**	**NO_3^- (mg/Kg)**	**nitrate(mg / kg body weight**
T_1r_1	0.36	0.0060	11.6	0.1933
T_1r_2	0.71	0.0118	2.2	0.0367
T_1r_3	0.10	0.0017	188.6	3.1433
T_1r_4	0.87	0.0145	2.3	0.0383
T_2r_1	1.12	0.0187	465.0	7.7500
T_2r_2	0.34	0.0057	4.9	0.0817
T_2r_3	0.42	0.0070	1.2	0.0200
T_2r_4	0.36	0.0060	94.7	1.5783
T_3r_1	0.40	0.0067	148.7	2.4783
T_3r_2	0.34	0.0057	3.2	0.0533
T_3r_3	0.62	0.0103	93.3	1.5550
T_3r_4	0.44	0.0073	8.3	0.1383
T_4r_1	0.38	0.0063	2.5	0.0417
T_4r_2	0.60	0.0100	519.3	8.6550
T_4r_3	0.36	0.0060	69.4	1.1567
T_4r_4	1.01	0.0168	73.1	1.2183
T_5r_1	0.36	0.0060	125.7	2.0950
T_5r_2	0.28	0.0047	61.9	1.0317
T_5r_3	0.95	0.0158	1.0	0.0167
T_5r_4	0.38	0.0063	0.5	0.0083
Free	0.36	0.0060	0.5	0.0083

Table 2: Nitrite and nitrate amounts of tomato samples and their daily intake if one 60kg body weight person feed one kg tomato.

Tomato samples	**NO_2^- (mg/Kg)**	**nitrite(mg / kg body weight)**	**NO_3^- (mg/Kg)**	**nitrate(mg / kg body weight)**
A11	n.d.	n.d	0.15	0.0025
A12	0.26	0.0043	0.046	0.0008
A13	n.d.	n.d	n.d.	n.d
A21	0.46	0.0077	n.d.	n.d
A22	n.d.	n.d	0.15	0.0025
A23	n.d.	n.d	0.303	0.0051
A31	n.d.	n.d	1.26	0.0210
A32	n.d.	n.d	0.51	0.0085
A33	0.24	0.0040	0.17	0.0028
A41	n.d.	n.d	0.165	0.0028
A42	n.d.	n.d	0.21	0.0035
A43	n.d.	n.d	n.d.	n.d
P11	n.d.	n.d	0.037	0.0006
P12	n.d.	n.d	1.14	0.0190
P13	0.24	0.0040	n.d.	n.d
P21	0.52	0.0087	0.82	0.0137
P22	n.d.	n.d	0.87	0.0145
P23	n.d.	n.d	0.046	0.0008
P31	0.76	0.0127	0.97	0.0162
P32	n.d.	n.d	0.17	0.0028
P33	n.d.	n.d	2.67	0.0445
P41	n.d.	n.d	1.06	0.0177
P42	n.d.	n.d	0.147	0.0025
P43	n.d.	n.d	0.202	0.0034
M11	n.d.	n.d	n.d.	n.d
M12	n.d.	n.d	n.d.	n.d
M13	n.d.	n.d	n.d.	n.d
M21	n.d.	n.d	0.073	0.0012
M22	n.d.	n.d	0.36	0.0060
M23	n.d.	n.d	n.d.	n.d
M31	n.d.	n.d	0.027	0.0005
M32	n.d.	n.d	0.49	0.0082
M33	n.d.	n.d	n.d.	n.d
M41	n.d.	n.d	n.d.	n.d
M42	n.d.	n.d	n.d.	n.d
M43	n.d.	n.d	n.d.	n.d
Free	n.d.	n.d	0.055	0.0009

n.d. = not detected

Some of instruments that used in this research:



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