

References

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3 - 59 Effects of Electron Beam Irradiation to Aroma Components in Liquor

Lu Dong, Zhang Miaomiao, Cao Guozhen and Li Wenjian

Different dosages (500, 750, 1000, 1250, 1500 Gy) of 1.5 MeV/u electron beam were irradiated liquor samples to study the improvement of aging effects. After irradiation, control six samples' quality and quantity were analysed by gas chromatography. We have analyzed 56 kinds of aroma substances such as aldehydes, alcohols, esters, acids. There are 25 kinds of substance's content remarkable changed. As shown in Table 1, there are three kinds, acetaldehyde, furfural, acetal change significantly, as well as n-amyl alcohol, 14 kinds of esters such as ethyl formate, ethyl acetate, acetic, propionic and 7 kinds of other acids. This result shows that contents of liquor aroma substances can be changed by the electron beam irradiation, and these changes are mainly esters and acids.

Table 1 Concentrations of changed aroma components in liquor samples

| Number | Component name | Component Amount(g/L) | | | | | |
|--------|--------------------|-----------------------|--------|--------|---------|---------|---------|
| | | Control | 500 Gy | 750 Gy | 1000 Gy | 1250 Gy | 1500 Gy |
| 1 | Aldehyde | 0.101 | 0.104 | 0.104 | 0.109 | 0.118 | 0.114 |
| 2 | Furfuraldehyde | 0.032 | 0.033 | 0.028 | 0.029 | 0.027 | 0.025 |
| 3 | Acetal | 0.241 | 0.239 | 0.236 | 0.243 | 0.262 | 0.252 |
| 4 | N-amyl alcohol | 0.016 | 0.017 | 0.017 | 0.001 | 0.001 | 0.001 |
| 5 | Ethyl formate | 0.166 | 0.170 | 0.168 | 0.173 | 0.179 | 0.171 |
| 6 | Ethyl acetate | 0.826 | 0.783 | 0.774 | 0.768 | 0.788 | 0.764 |
| 7 | Ethyl propionate | 0.067 | 0.066 | 0.066 | 0.043 | 0.046 | 0.069 |
| 8 | Ethyl butyrate | 0.280 | 0.252 | 0.248 | 0.242 | 0.247 | 0.242 |
| 9 | Ethyl iso-butyrate | 0.007 | 0.007 | 0.007 | 0.002 | 0.002 | 0.007 |
| 10 | Ethyl lactate | 0.792 | 0.780 | 0.763 | 0.782 | 0.791 | 0.769 |
| 11 | Ethyl valerate | 0.045 | 0.038 | 0.038 | 0.036 | 0.037 | 0.036 |
| 12 | Ethyl hexanoate | 2.226 | 1.801 | 1.757 | 1.634 | 1.676 | 1.683 |
| 13 | Ethyl oenanthate | 0.015 | 0.012 | 0.011 | 0.010 | 0.010 | 0.010 |
| 14 | Ethyl caprylate | 0.005 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| 15 | Ethyl palmitate | 0.014 | 0.000 | 0.000 | 0.000 | 0.009 | 0.000 |
| 16 | Ethyl Oleate | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 17 | Ethyl linoleate | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 18 | Ethyl decanoate | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| 19 | Acetic acid | 0.350 | 0.351 | 0.347 | 0.357 | 0.366 | 0.361 |
| 20 | Propionic acid | 0.013 | 0.013 | 0.014 | 0.016 | 0.018 | 0.021 |
| 21 | Isobutyric acid | 0.004 | 0.005 | 0.005 | 0.006 | 0.009 | 0.013 |
| 22 | Butyric acid | 0.146 | 0.145 | 0.144 | 0.147 | 0.149 | 0.147 |
| 23 | Isovaleric acid | 0.014 | 0.014 | 0.014 | 0.014 | 0.015 | 0.015 |
| 24 | Valeric acid | 0.017 | 0.017 | 0.017 | 0.018 | 0.018 | 0.018 |
| 25 | Hexylic acid | 0.566 | 0.569 | 0.561 | 0.566 | 0.571 | 0.561 |

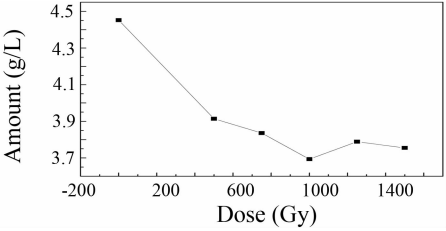


Fig. 1 Amount of total ester in different liquor samples.

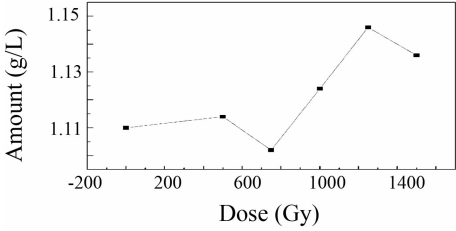


Fig. 2 Amount of total acid in different liquor samples.

Overall changes of esters and acids in control and irradiated samples are shown in Figs. 1 and 2. As we can see in Fig. 1, along with the increase of the irradiation dose, total ester content in the liquor shows an overall downward trend. When the irradiation dose comes 1000 Gy, the total ester content have a minimum value 3.694 g/L which means an 17% decline compared with control. In Fig. 2, total acid content in the liquor shows upward trend with increasing of irradiation dose. When irradiation dose comes 1250 Gy, the total acid content reached the maximum value 1.146 g/L which means an 3% increase compared to the control. In a conclusion, electron beam can degrade esters in liquor. Meanwhile, esters were decomposition into alcohols and acids, and the acids were reduced to aldehydes. So compared to the rise of total acid esters degradation is even more apparently.

3 - 60 Effect of Electron Beam Irradiation on Aging of Liquor

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Different dosages of electron beam were irradiated liquor samples to study the improvement of aging effects. Both Light-flavor liquor and Luzhou-flavor liquor were irradiated by electron beam(1.5 MeV/u) with the dosages of 500, 750, 1000, 1250, 1500 Gy respectively. Control and irradiation liquor samples were scanned the UV spectra between 200 to 400 nm. Figs. 1 and 2 are Luzhou-flavor liquor 1573 and Light-flavor liquor Jinkang sweet sorghum UV spectra respectively.

As shown in Fig. 1, the spectrum curve changes between 260 nm to 280 nm of control and irradiated samples are significant. Different from control, there are two peaks in irradiated samples at 267 nm, 272 nm and a trough at 270 nm. From 280 to 300 nm, with the irradiation dosages were gradually increased from 0 to 1500 Gy, Luzhou-flavor liquor 1573 has an absorbance value downward trend. That shows good effect of liquor aging^[1-2].

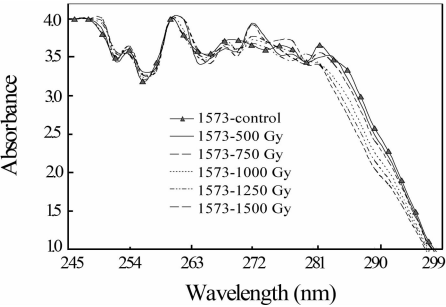


Fig. 1 The UV spectra of Luzhou-flavor liquor 1573.

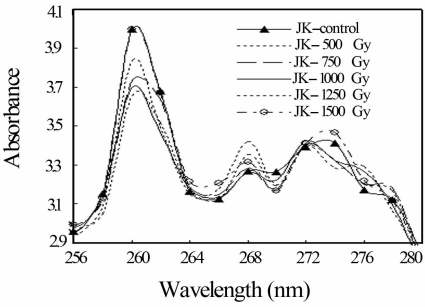


Fig. 2 The UV spectra of Light-flavor liquor Jinkang.

As shown in Fig. 2, Jinkang sweet sorghum liquor JKvalues was declining from 256 to 264 nm with the irradiation dosages were gradually increased from 500 to 1250 Gy. That shows aging trend of liquor. At dosage of 1500 Gy, the irradiated sample has the same spectral curve as control which means the retrogradation of liquor aging phenomena. From 264 to 280 nm, there are two peaks at 268 nm and 273 nm in