Japan Analytical Industry Co., Ltd.

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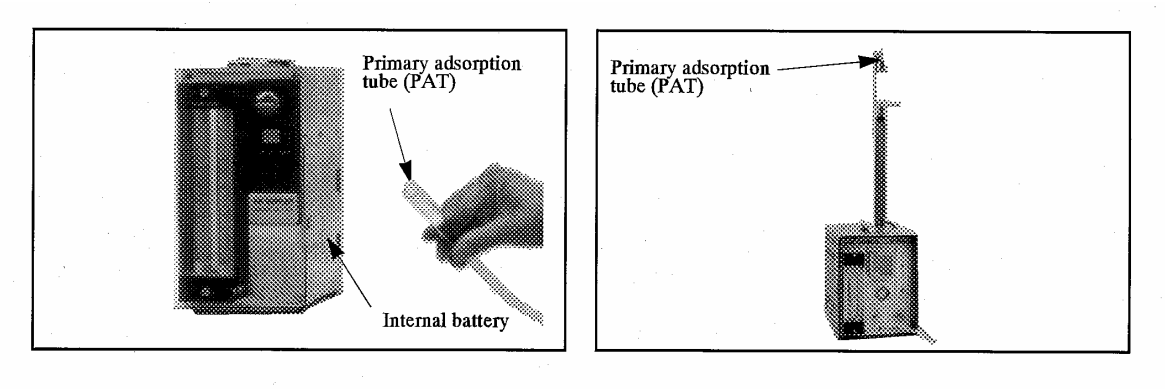
VOC analysis in the Cleanroom

1. Sampling Method

Sampling tool for volatile organic compounds (VOC) is shown in Fig. 1.



Model Al-410 Model Al-430

Fig. 1 Photos of air samplers

Both air samplers are designed to collect gas in environmental or cleanroom air into a primary adsorption tube (PAT) by suction. The samplers can be operated by internal battery. The samplers have the same capability. However, model AL-430 includes a flow calculator.

The samplers can be sucked air with 1,000 ml/min of flow rate in order to samlple a large amount of the air in the cleanroom, because diameter of the primary adsorption tube (PAT) for Purge & Trap sampler model JHS-100A has excess wide bore (i.d. 12 mm) against to the other company's tubes.

Normally, 40-50 mg at the most of adsorbent are packed into the other company's tube. However, illustrated adsorbent on Fig. 2 was packed in the PAT.

In order to evaluate the VOC in the cleanroom, a larger sampling volume is needed. According from our experience, JAI recommends total of 10,000 ml (1,000 ml for 10 to 20 min) of the air for VOC analysis in the cleanroom .

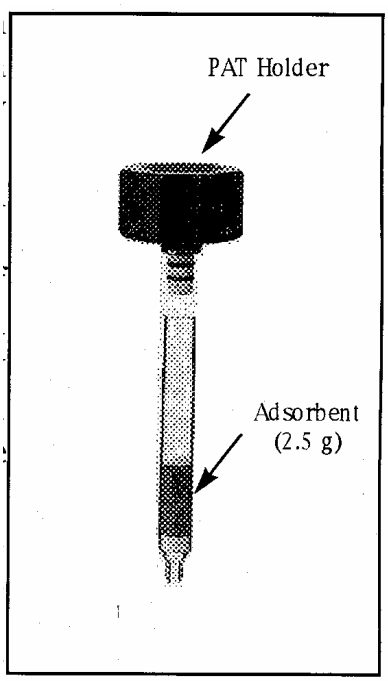


Fig. 2 Primary adsorption tube

The PAT widely conduce applications for VOC analysis from Hard Disk, wafer, liquid crystal display and other electronic devices. i.e. after VOC collection by a PAT, the PAT with PAT holder then transferred to purge & trap sampler JHS-100A and GC/GS. So that VOC characterizaljon can be performed.

2. VOC Analysis of LCD Manufacturing Processes

Figure 3 shows the chromatograms of VOC obtained from the 5 manufacturing processes in the LCD industry.

Total VOC amounts in the chromatograms are summed up as the total ion currents. (15 ,120)

The chromatogram obtained from rubbing room was also similar to that of the coating room. However, from both total VOC amounts, 14 % of exhaust gas from coating room entered into the rubbing room by circulation.

(Total VOC amount : 2,130)

By the way, the sealing & printing room is located next to the coating room, but, cellosolves and NMR peaks from the coating room airs are not observed in the chromatograms of the sealing and printing room.(Total VOC anrount : 2,066)

The acetone and IPA detected in the sealing & printing room came from the rubbing room.

In the fourth chromatogram from the top, absence of VOC in the blending room indicates an ideal cleanroom condition.

(Total VOC amount : 42)

At the degassing room, liquid crystai injected into the display is heated in order to remove bubbles in the liquid.

The chromatogram of the degassing room air shows similar chromatogram as of rubbing room. However, we could not determine it the VOC came from the rubbing room or from the exhaust from the liquid crystal.

Also, the total VOC amount was calculated to be 1,137.

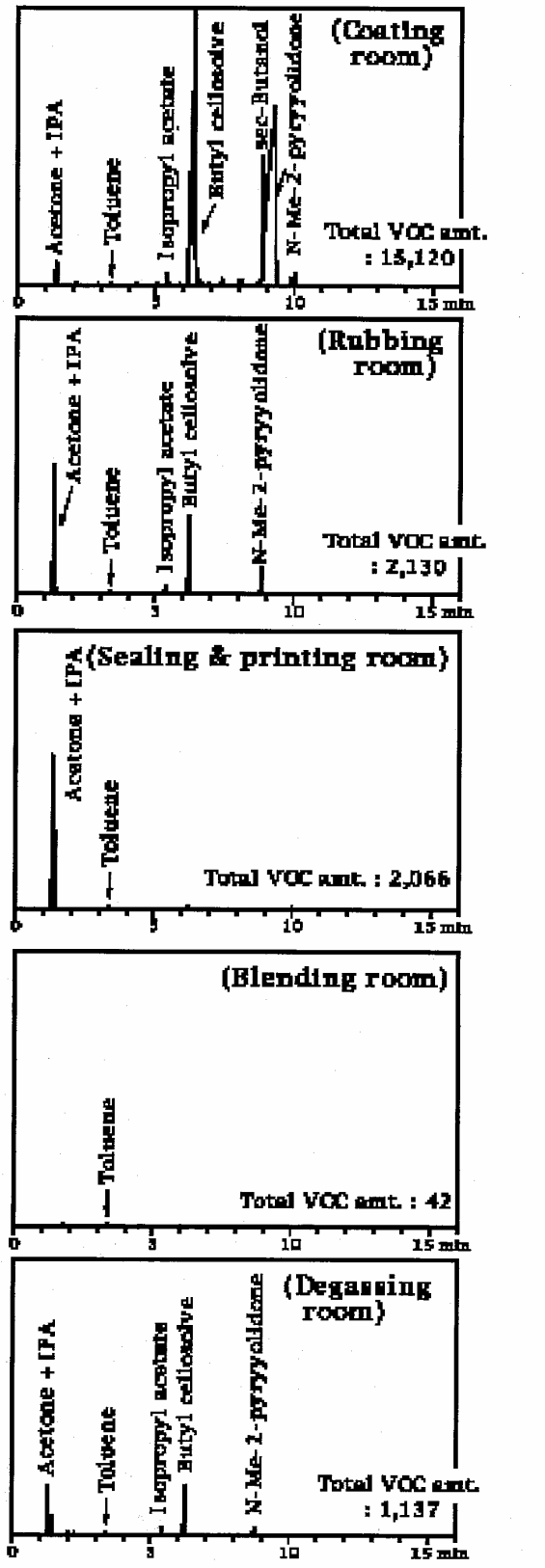


Figure 3 The chromatograms of VOCs obtained from the 5 manufacturing process is in the same LCD industry

3. Modification of ventilation order in the cleanroom

Ideal cleanroom condition at the blending room is shown in the fourth chromatogram from the top of Fig. 3.

However, the ideal chromatogram was obtained after the modification of ventilation order in the cleanroom with changing the flow rate and the passthrough order in the cleanroom.

Before and after chromatogram were shown in Fig. 4.

The before chromatogram (the top) was obtained. Butyl cellosolve acetone, IPA, NMP and iso-propyl acetate were observed. The total VOC amount for was 606.

The after modification chromatogram was same as Fig. 3, on this case, the total VOC amount was only 42 .

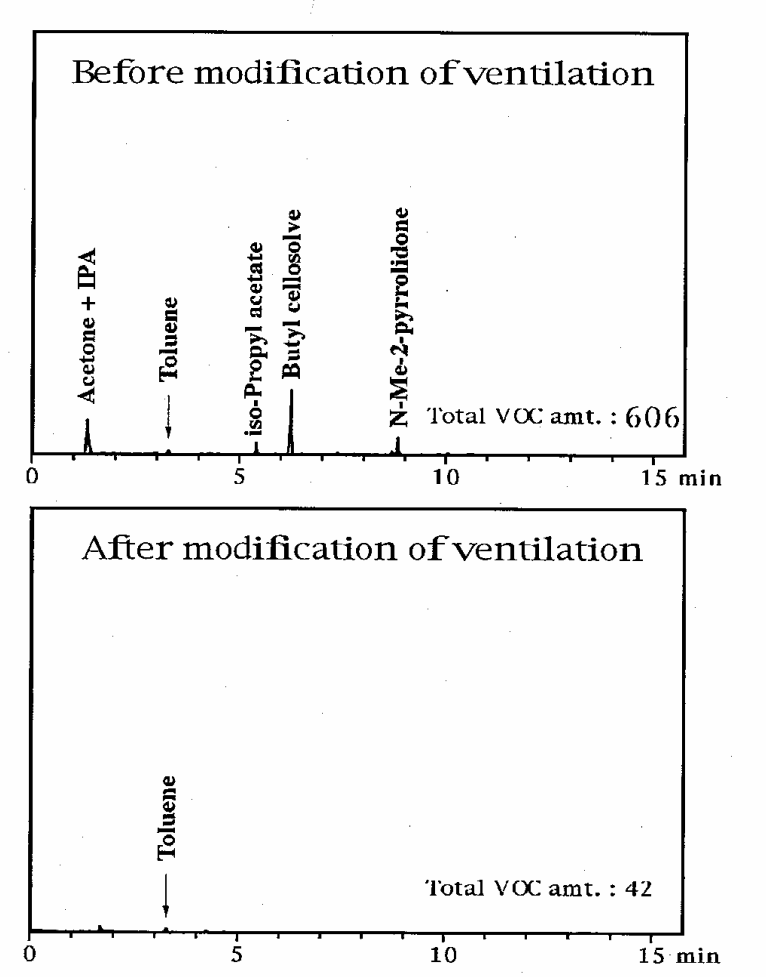


Figure 4 VOC chromatograms of before and after modification of ventilation at the blending room in the clcanroom

As a result, it is clearly that the ideal VOC condition for the bending room was obtained by measurement of VOC by using the air sampler and P&T-GC/MS.