Research on the Choice of Printing Methods of 2D Barcode Label for Lubricants

Ping Zhao, Xia Zhu*, Shucheng Xiao, Junbin Chen, Xiaoling Yao, Qiaoqiao Yan, Weihua Huangfu

Logistical Engineering University

Chongqing 401311, China

**Correspondence: zhuxia114@sina.com*

Abstract: The choice of technology of label production plays a significant role in the whole process of lubricant manufacturing, management and application in oil depot. The paper expounded how to choose the printing methods during the process of production of 2D barcode labels for lubricant. Substrates of 2D barcode can be plastics, polyester, synthetic fiber, steel plate, iron plate, corrugated board, PE and PVC synthetic material and pressure-sensitive adhesive.The choice of printing methods depends on the substrates of 2D barcode for lubricant and the packing containers of lubricant while the features of printing methods and applications for lubricant are accounted important .

Keywords: lubricant; 2D barcode; printing methods

The production of 2D barcode labels is the prerequisite of the applicability of 2D barcode labels for lubricant. Therefore the choice of technology of label production plays a significant role in the whole process of lubricant manufacturing, management and application in oil depot.

QR 2D barcode for lubricant are generally designed by computer programming and are printed on either packaging or labels mainly with printing machines, which are more convenient. The choice of printing method depends on the substrate of barcode.

1. Substrates of Barcode

Carriers should be assessed and taken into account in the choice of printing methods.

Lubricant is now stored and used in some cases in the wild field, whether freezing cold or intensely hot, whether humid or arid. Besides, man-made sabotage can not be totally avoided. Such factors as high temperature, radiation, rain, friction and collision during the transportation might lead barcode to shed, fade, get stained and deformed, to the disadvantage of the correct scanning of barcode. Therefore, the substrate of barcode is supposed to be stable in its physical and chemical properties. It should be corrosion, high and low temperature-resistant (-40℃~50℃). It should be very tenacious and compact so that it would survive the friction, curlating and collision instead of becoming curly and torn.

According to the choice of packaging containers and producing program of 2D barcode, substrates of barcode can be plastics, polyester, synthetic fiber, steel plate, iron plate, corrugated board, PE and PVC synthetic material and pressure-sensitive adhesive.

2. Printing of 2D Barcode

2D barcode for lubricant can be either printed or pasted on the substrates, and the pressure-sensitive adhesives can be printed with printers or printing machines. Therefore printing quality is directly related to the applicability of 2D barcode for lubricant.

In the case of printing with printers, it is of vital importance to choose suitable printers and substrates, while in the case of printing with printing machines, printing methods, printability and printing ink should all be taken into consideration.

2.1. Printing Method of 2D Barcode for Lubricant

With the wide use of packaging printing and diverse substrates, different printing methods might be employed in real practice.

The presence of diverse substrates and their different surfaces make it more difficult for people in real practice to determine the printing method. Such factors as usage, requirements, properties of substrates and configuration of surface should be taken into account in the choice of printing methods. The features and examples of the various printing methods were listed in Table 1[1].

The choice of printing methods depends on the packing containers of lubricant and the substrates of 2D barcode for lubricant.

2.2. Choice of Printing Method of 2D Barcode for Lubricant

2.2.1. Plastic Container

There are generally 10 kinds of plastic containers of lubricant for military purpose: 20 liter static-free flat handle drum, 20 liter mold drum, 10 liter mold drum, 4 liter blown container, 1 liter blown container, 2 kilogram plastic box, 1 kilogram plastic box and 250 gram plastic box, 150 gram flexible tube and 100 gram plastic bottle.

These containers, which vary in size, shape and specification, are cheap and fit for mass production in com-

Table 1. the features and examples of the various printing methods

Printing method	Main features	examples
Relief printing (flexography)	Fit for line copy; rich and bright in ink color	Printing of trade mark, label, packing box, packing paper, and pressure-sensitive adhesive
Planographic offset printing	Fit for continuous tone copy and rich in graduation of colors with a wider range of usage	Printing of advertisement, sample, packing, trade mark, wall calendar, and metal printing
Recess printing	Rich in ink and graduation of colors and fit for flexible package printing	Printing of plastic container bag, compound bag, wall paper and building material
Screen printing	Rich in ink and fit for solid state surface printing	Printing of paper, paperboard, vegetable ink printing and printing of various containers including china and pot

Table 2. A comparison of the 3 printing methods in printing plastic containers.

	Thermal Transfer Printing	Offset Printing	Screen Printing
Printing quality	High in quality and anti-counterfeiting	Accurate and uniform in color	Tolerance in register, dislocated image and ununiform in color
Cost	relatively high (printing machine, RMB 30,000-50,000 and 1.5 per mold)	Medium cost	Low and plate can be used repeatedly.(printing machine, RMB 1000 per color, film, screen mesh and plate 150.)
speed	About 20 per minute	About 15 per minute	10 per color per minute
Other properties	Printing can be finished once.Fit for mass production	Printing can be finished once.Fit for mass production	More than one printing machines are needed in printing barcode of more than one color. Printing can not be finished once. Fit for small-scale production

parison with metal containers and grease cartridge. It is also convenient to print packing mark on them.

Now offset printing, screen printing and thermal transfer printing are generally used to print packing mark on plastic containers.

Screen printing gets its name because the forme is reticular and the ink under the pressure of squeegee goes through the mesh openings in the forme and is printed on the substrate.

Fig.1 and 2 show how offset printing and screen printing machine works differently.

Planographic offset printing is the printing with planographic plate. Different from direct printing methods, the printing ink is generally transferred to the rubber blanket and then printed on the substrate. It is the most widely employed printing method at present in that it is time-saving, cheap and speedy[2].

Thermal transfer printing, as Fig.3 shows, gets it name because in printing, sublimely dye-based ink or other material is printed on back together with the substrate, thus leading dye-based ink to sublimate.

In the case of lubricant for military purpose, which is usually stored for a longer time, used and transported in a severer condition than lubricant for civil purpose, the protecting and marking functions of packing should be strengthened. The packing mark printed by thermal transfer printing machine is uniform in color, clear and less likely to get stained and fall off. In comparison with offset printing and screen printing, the barcode printed by thermal transfer printing machine is high in quality, anti-counterfeiting, and productivity and meet the requirements of packing for lubricant for military purpose. Therefore, thermal transfer printing should be the printing method of choice in the practice of printing of 2D barcode label for lubricant.

2.2.2. 340-gram grease cartridge

The main body of 340-gram grease cartridge is paper-plastic composite with paper as the matrix, with the inner and outer walls coated with polyethylene (PE) or polyvinyl chloride (PVC) composite plastic film. One end is metal easy-open end and the other perfectly mobile plastic end. The use of it as well as No.1 grease compressor makes it more convenient and quicker to compress grease, which has been proved a quite practical packaging method of lubricant.

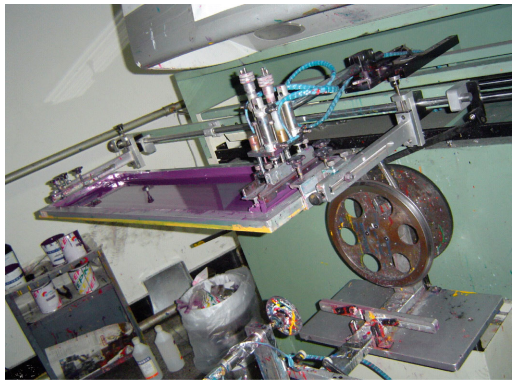

Figure 1. Screen printing machine, which prints

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one single color once (The color of purple is being printed in the chart.)

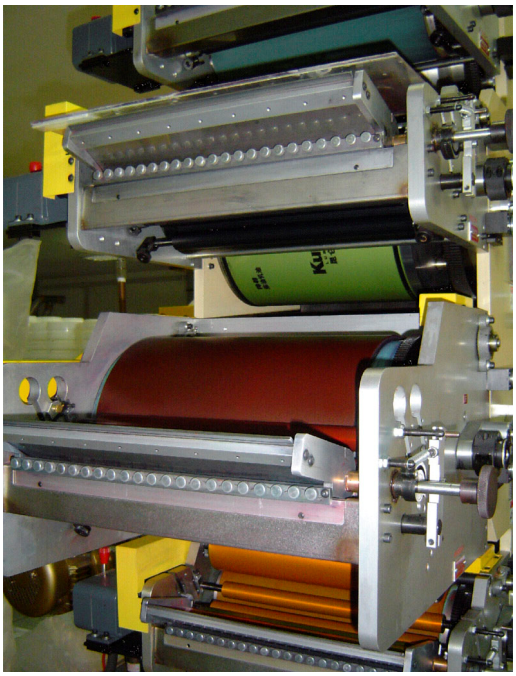

Figure 2. Offset Printing Machine (All the colors can be printed once.)

Figure 3. Packing mark is being printed by thermal transfer printing machine on the plastic drum with the paper being heated from its back.

Different from other packaging containers, its matrix is composite paper madeof PE and PVC-coated paper. The grease cartridge is easy-open and portable. These properties should be fully considered in choosing suitable printing method.

Recess printing of soft package is now widely used in printing grease cartridge. As one of the specialty printing methods, It is developed from mandrel photographic gravure printing and employed mainly in printing paper bags and composite paper made of PE-coated paper.

2.2.3. Metal Container

Metal containers are widely used packaging containers of lubricant. There are totally 12 kinds of metal containers of lubricant for military purpose: 200 liter, 100 liter, 80 liter steel drum, 20 liter steel pail (T-type), 20 liter steel pail (S-type), 4 liter drum, 10 liter iron can, 4 kilogram iron can, 1 kilogram iron can, 1 liter iron can, 0.5 kilogram iron can and 20 liter flat steel pail.

Metal container is solid and enduring, its surface smooth and clean, and it can protect its content very well. Spray painting and printing are usually used to produce packing marks of lubricant, which are bright and clear in color and readily recognizable.

In the case of the large-volume drum such as 200 liter, 100 liter and 80 liter steel drum, spray painting is widely used in the production of packing marks while in the case of small-volume metal containers such as 20 liter drum and below, the steel or iron plate of which is thin and small, the packing marks are usually printed.

Planographic offset printing and letterset printing are generally used in the case of metal containers. They are also categorized into specialty printing. They keep such hard materials as metal plate, molded metal products, metal foil, etc as substrates. The common substrates are tinplate, tin-free steel plate (TFS), galvanized steel plate, black plate, aluminum plate, punched aluminum container, galvanized iron composite material, etc. Its printing methods vary from substrate to substrate, as show in Table 3. Among them, offset printing takes the lead.

2.2.4. Corrugated paper box

Flexographic printing is the method of choice in printing corrugated paper box. It refers to the printing method with flexograph, in which ink is delivered by anilox roller. Flexograph includes all the relief printing plates such as rubber plate and photopolymer relief plate. The properties of flexographic printing are listed in Table 4 in comparison with planographic offset printing and recess printing.

2.2.5. Pressure-sensitive adhesive label

2D barcode pressure-sensitive adhesive labels are now widely used as labels for lubricant, which are pasted on packing containers of lubricant.

Pressure-sensitive adhesive labels are also referred to as self adhesive label. The printing layer of the pressure-sensitive adhesive label can be peeled off and pasted conveniently. It is heat and humidity resistant. It is environmentally friendly and less likely to be degraded. Therefore, pressure-sensitive adhesive labels are now widely used in packaging printing.

The different levels of the development of economy, science and technology in different areas, have a great impact on their choice of printing method in printing pressure-sensitive adhesive labels, as shown in Table 5[1].

As it is shown in Table 5, flexographic printing takes the lead in pressure-sensitive adhesive labels printing in the developed countries, while in China, relief printing are

Table 3. Printing methods of metal containers and their examples.

Substrates		Printing methods	Main products
Shape	**Material**		
Coiled material	galvanized steel plate	Recess offset printing	Building material (interior and exterior decoration), decorative plate (electrical equipment, furniture, etc.)
Sheet material	Tinplate, TFS, aluminum plate and black plate	Planographic offset printing, letterset printing, recess offset printing, and screen printing	Filling vessel, container of cookie, drug, ornament, oil, paint, dry battery, lid, toy, sign, display, decorative plate (home appliance and kitchenware)
Foil	aluminum	Photographic gravure printing	Aluminum foil container
Products	Punched aluminum container, composite container of aluminum and galvanized iron, flexible pipe	Letterset printing, screen printing and thermal transfer printing	Ornament, container of beverage, tooth paste, drug and food

Table 4. The properties of flexographic printing.

Printing method properties	Flexographic printing	Planographic printing	Recess printing
Printability	Excellent: paper, paperboard, corrugated paper box, plastic film, aluminum foil, etc	Medium: paper including coated paper, offset paper, newsprint, etc	Excellent: thin film, paper, aluminum foil, etc
Accuracy	Medium: 150lpi-175lpi	Fine: 175lpi-200lpi	Excellent: 300lpi
Quality	Fine	Fine	Excellent
Printing pressure	Excellent: 1 kg/cm-3 kgcm	Fine: 5 kg/cm-6 kgkg/cm	Medium: ＞50 kg/cm
Thickness	Fine: 3μm-5μm	Medium: 1μm-2μm	Excellent: 8μm-15μm
Speed	Excellent	Fine	Excellent
Pressure resistance of printing plate	Fine: ＞500,000	Medium: 100,000-300,000	Excellent: 2,000,000
Cost	Fine	Excellent	Medium
Rate of loss of paper	Excellent: 1%-3%	Medium: 8%-15%	Excellent: ＜5%
Price of printing machine	Excellent	Fine	Medium
productivity	Excellent	Fine	Fine
Environmental effect	Excellent (water-based ink and UV ink)	Medium	Medium

Table 5. The percentages of various printing methods in pressure-sensitive adhesive labels printing in both European and American countries and the Asian-Pacific region(%).

Printing methods areas	Flexographic printing	Relief printing	Planographic offset printing	Screen printing	Recess printing	Printer printing
European and American countries	75	15	2	2	2	4
Asian-Pacific region	4	70	20	3	1	2

Table 6. The printing methods of choice corresponding with various carriers in printing 2D barcode labels for lubricant.

carriers printing methods	Plastic containers	340g grease cartridge	Metal containers	Corrugated paper box	Pressure-sensitive adhesive
Printing methods	Thermal transfer printing	Recess printing	Planographic offset printing	Flexographic printing	Flexographic printing

still most widely used (75%) and flexographic printing accounts for only a quite small percentage instead. In terms of printing quality, productivity and cost, flexographic printing should be the choice of printing method in pressure-sensitive adhesive labels printing. However, considering the current situations, relief printing can still be used.

The printing methods of choice corresponding with various carriers in printing 2D barcode labels for lubricant are listed in Table 6.

3. Conclusion

From the above discussion, it can be concluded that the printing methods of 2D barcode labels of lubricant should be determined according to the packaging type and material. In the present study, printability of various printing methods was explored to draw the match among

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the carriers, suitable printing methods and printing ink to guarantee printing quality.

Correct choice of printing method is the prerequisite of production of 2D barcode labels and guarantees the practical application of 2D barcode labels for lubricant.

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