MAP PRODUCTION AND ECOLOGY

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Abstract

Printing industry contaminates remarkably the environment. Various waste materials originate at the map production.It is possible to classify them as dangerous chemical aids and solid and liquid wastes, which are partly recyclable and partly are removed to waste dumps.

Some chemical aids influence negatively waste waters and it is necessary to treat them before pooring out into sewers. New waste-free technologies are mentioned with recommendation for their application in map production and reproduction.

1. Introduction

The present state of the environment is going from bad to worse. Disquieting is especially the speed of this destructive process, which permanently grows during latest years.

Even though the map production does not fall into decisive industrial branches, which have substantial negative influence on the environment, it envolves many wastes, which are unfavourable for flora as well as for fauna. These represent particularly solid wastes, which are removed to waste dumps and hereafter various chemical aids, necessary for photographical and other processes, which contaminate the waste waters.

2. Classification of wastes

The kind of wastes originating at map production and reproduction, changes depending upon used production technologies. These wastes can be divided in principle into :
- dangerous chemical aids, which can immediately endanger the human health,
- solid and liquid materials, which can be futher divided into recyclable and unrecyclable wastes.

2.1 Dangerous chemical aids

At the beginning of the second half of our century there were removed through technological changes in most

countries chemical aids, which immediately endangered the human health. It was in the first place removing of poisons used in photographic processes, e.g. mercury chloride in photographic intensifiers. Sensitized coatings for copying of offset plates and positive or negative images on plastics (Eggen copy system) used ammonium or potassium dichromates, which are poisonous and carcinogenic and can cause uncurable skin eczemas. These chromium salts were also used in photographic processes for removing of veil on negatives, for their density intesification or reduction and as a substance of bleaching baths at the photographic reversal processes.

While the strong active poisonous chemicals were always gathered and delivered to the chemical destruction, other chemicals (incl.chromium salts) were poored out - with other waste waters from the production - directly into sewers. Their concentration in many cases exceeded permissible hygienic standards.

Czech standards for waste waters allow e.g. a maximum short-term concentration 0,1 mg of dichromate and 0,5 mg of chromate salts per liter. This standard was exceeded at coating of printing plates or plastics in centrifuges in short-term intervals 20 till 30 times, while during this process more than 70% of sensitized solution run upon into waste waters.

The production of printing plates was in latest years hygienically secured by introduction of fully ecological pre-coatings. But it was necessary to deal with the problem of copying on plastics, which for its undoubtedly favourable characteristics (especially the possibility of subsequent copying of new elements, in principle without any time limitation) was frequently used in many European countries. The process uses natural or synthetic colloids (gelatine, gum arabic, polyvinyl alcohol etc.) sensitized by dichromate salts. These are at the exposure reduced. Through a complicated photochemical reaction chromium chromate $(Cr_2O_2)CrO_4$ is created, which hardens the colloid coating and enables to product a so called "stancil copy". It is possible to colour it (at the negative process) or to paint it over by a special dye, dissolved in an organic solvent (at the positive process) with follow-up removing of the hardened coating.

If it is necessary from technological point of view to save this technology, the problem of dichromate and chromate salts can be solved as follows :

- the sensitized coating will be put on the plastic by a special coating device R-Coater (German product), which works free of waste,
- for removing of the hardened coating is used a special device FEVA (German product). This device enables filtering and recyclation of the waste water. Concentrated chromium salts are collected in tanks and delivered to a chemical factory for recyclation of chromium.

Except from chromium salts were formerly used some further harmful substances, as e.g. lead and lead-base alloys at the hand or hot-machinery composition. These techniques are either no more used or are retreating.

2.2 Solid wastes

At the map production a significant quantity of solid wastes is developing. The greatest part of them represents the waste paper (till 90% of the volume). The waste paper is partly utilizable (e.g. bigger shavings for production of pads, blocks etc.), the rest of it builds untreatable waste. This can be further divided into recyclable waste, which includes the blank or not much overprinted paper, stubs etc., and into non-recyclable waste, i.e. spoiled paper sheets, laminated or coated paper sheets etc. These wastes are burned up - in many cases imperfectly so that arising combustion products contaminate the atmosphere - or delivered to dumping grounds.

Other solid wastes from map production and reproduction are:
- metallic materials, which are collected and bought out as secondary raw materials (e.g. used mono- and trimetallic offset plates, washed out tins from printing inks etc.,
- used silver-halide films, which are raw materials for metal silver recyclation,
- plastics of various types, which are mostly delivered to dumping grounds,
- rests of printing inks and non-washed tins, which are also delivered to dumping grounds,
- textile materials, soiled by printing inks and by various crude oil products, used for cleaning, lubrication and conservation of machines - these are burned up or delivered to dumping grounds.

2.3 Waste waters

From liquid wastes originating at map production only exhausted fixing bath, used for metal silver recyclation, are collected. Other wastes (developers, short stops etc.)

are drained off into sewers after precedent separation of oil rests and other oil products.

3. Environment-friendly technologies

At present time many technologies, which do not damage the environment, are appearing. These technologies can be used both for photographic and for contact printing of the map image.

3.1 Films

Application of silver-halide films is the mostly used technology for fair draughts reproduction. There are used negative as well as direct positive or reversal films on PET-plastics with a high dimensional stability.

Negative working films for dark-room processing can be successfully used only by application of pre-punch registration systems. The contact printing process uses combining of two or more negative images in order to form a single positive copy. It is possible to combine line elements with patterns using negative masking and negative pattern images.

This technology is very convenient for printing of map images prepared by negative scribing. As some of originals have a positive image (e.g. the lettering overlay), it is possible to print them using a direct positive film and the yellow filter.

For contact printing and for duplicating of positives day--light films, sensitized to UV-radiation, are usually used. It is possible to process them by a soft day light.

The image on photographic materials is gained through the chemical developing, usually in steep working lith - developers, recommended by film producers. The fixing of the image, a carefully washing of the film in running water and its drying is necessary. All these works are reliably secured using film developing machines. The disadvantage of these processes is only a considerable consumption of chemicals and of the water, the price of which is permanently increasing.

3.2 VERDE-films

The chemical processing of usual photographic materials brings certain ecological risks. These are removed by a new type of so-called VERDE-film, developed by Xerox Research Centre of Canada as an outside research product in

the branch of electrography. The image is built in a shallow polymer coat with selenium particles. These are electrically topped up. The image is developed after exposure only by heating without any chemicals. The influence of both light and heat causes, that the selenium molecules penetrate more or less into the depth of the polymer coat in dependence on the light quantity and create a stable image for further printing. Its quality is fully comparable with high-quality silver-halide films. There are no special conditions for storing of VERDE-films, while their coat without electrical topping is not light-sensitive. This simple and fully ecological procedure of image processing brings not only reduction of power consumption but particularly of using water too. The resulting image can be immediately used for further printing.

3.3 Diazo-films

Diazo-films have bigger and bigger importance at the map processing, especially for duplicating of line and pattern images.

The process is a direct positive one. At places, where the diazo-coating was not exposed, the image is created in ammmonium vapours. The coat is exposed by UV-light - at the map production mostly in vacuum frames, where using of pre-punched materials is possible. For developing special devices with closed ammonium circulation are used. This technology is a fully ecological one.

The problem of printing of opaque and screened areas using diazo-films was solved in the Czech Republic by combination of negative and positive masking. For printing of a pattern into a given area the negative mask of this area is simultaneously exposed with a positive image of the pattern. For printing of opaque areas (in the value 100%) a positive mask, which simultaneously covers the former exposed areas with patterns, is used.

The tonal ranges for printing of uniform tinted areas are copied separately. Printing masters for both lines and areas elements are prepared through joint exposure at the final step of the reproduction.

3.4 Other non-silver materials

There are many non-silver coats, which can be used without ecological damage. To new materials introduced in the Czech Republic belongs the negative copy on PVN-foil produced by Renker Co.(Germany). The coat is sensitized to UV-light only. The processing can be provided at the soft

day light. After exposure the image is developed by a fine water shower. After drying a durable image will appear with a sufficient density for further printing on UV-sensitized coats. Its density is 2,5 - 2,7 for the UV-light, but only 1,1 for the yellow light. The PVN-foil can replace by contact printing negative working silver-halide day-light films. The developing using water is a fully ecological one.

3.5 Pre-press proofing

The pre-press proofings are usually used for revision of the full-coloured map image before its offset printing. Former press proofing is step by step abandoned and supplied by various types of colour proofs. It is possible to divide them into :

- overlay proofs, which use 4 or more thin transparent foils, on which the image is created in chosen printing colours. The total colour perception will appear through their common light diffusion,
- single sheet proofs, where the colour image is created on a single base sheet, which can be represented by an opaque or by a transparent sheet (cardboard, plastic and others).

For processing of overlay proofs from positive masters diazo-films are mostly used (e.g. Kimoto Celsia Colour Proof). Colour pigmented pre-sensitized coats on plastics (e.g. 3M-Color Key, Du Pont-Chromacheck, Fuji Color Check) are meant for printing from negative masters. Pre-sensitized coats enable to gain an image in four secondary colours (i.e. yellow, cyan, magenta and black) or in others used for map offset printing (e.g. brown, green, violet etc.).

Single sheet colour proofs use various techniques for image creation. According to their principles it is possible to divide them as follows :

- superposed sensitized ink proofs - this technique is used for negative masters. The representatives are Kwik Proof, Watercote and drColor produced by Direct Reproduction Corporation, Quadracolor by Castcraft Industries Inc. or Hacolor by Hausleiter Co.,
- direct transfer colour proofs, which use pre-sensitized colour foils transfered from the tracer on the base sheet by a heat-press laminator. These copies can be produced from negative masters as well as from positive ones. Their representatives are Matchprint produced by 3M, Agfa-Proof of Agfa-Gevaert or Color-Art of Fuji,
- adhesive photopolymer dry powder colour proofs - at this technique the photopolymer coating is laminated on the

base sheet, exposed and developed by a colour powder. This technique is represented by Cromalin, produced by Du Pont. It enables to produce colour proofs from negative as well as from positive masters,

- photoelectric proofs, based on principles of electrographic image transfer using colour toners. The device KIMOFAX 6185-III. is produced by Kimoto Co. and enables to produce colour proofs from positive as well as from negative masters,
- photomechanical colour proofs based on contact printing using sensitized colloids on a PVC plastic foil - the oldest technique using originally dichromated colloids, was replaced in the Czech Republic by PLD-7 coat, using synthetic colloids sensitized by diazo-compounds.

4. Conclusions

The goal of this contribution was to refer to some ecological problems of map production connected with taking care of wastes and waste waters. Simultaneously new techniques and technologies were mentioned, use of which can contribute to a higher ecology of map production and protect the up-to-date environment.

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