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Quality Assurance of Process Free Thermal Plates

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Abstract:

In this paper a method for manual processing of process free printing plates is defined which ensures reproducible results. This decoating procedure can help print service providers with certain quality checks (like linearization) that are otherwise more expensive or even not feasible altogether for such plates. This method holds for quality assurance only and is not suitable for the actual production.

Keywords:

Offset thermal plates, Processless, Process free, Quality assurance, Linearization

1 Introduction

Process free (processless) thermal plates are offset printing plates that are processed (developed, decoated) by the printing press, in contrast to conventional printing plates that are processed in a specific processor (developer) before the printing process. For process free plates the coating is removed of the non-printing areas during the printing start-up within few rotations of the plate cylinder due to the tack of the ink. The coating and the ink is then transferred to the offset cylinder and further onto the substrate - thus removed from the printing plate. A technology overview is given in (Mahović Poljaček et al., 2015), see also (Cigula et al., 2015).

Exposed but not processed printing plates show, in general, a low-contrast latent image. However, since measuring analysis require a high-contrast image, decoating is necessary. Thus it is not possible to measure process free plates before printing. Figure 1 shows the difference in contrast between a decoated and a not-decoated process free plate. Further details can be found in (Ondrusch, 2012).

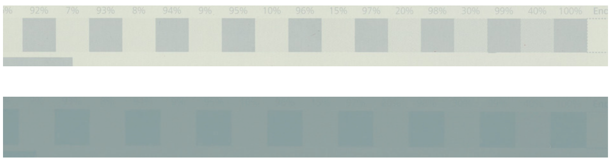

Figure 1: Contrast between exposed and not exposed areas on a processed plate (top) and on a not processed plate (bottom)

In particular, this difference becomes evident when defining a linearization curve (See e.g. (Belz, 2012)). The goal of a classical linearization of printing plates is to adjust tonal values during ripping so that the nominal tonal values (input data of the RIP) match those on the developed printing plate. To achieve this, it is necessary to measure on the developed printing plates by means of, for example, a plate reader. Thus for process free thermal plates the measurement can only be carried out after the printing process.

2 Theory

If x denotes tonal values, l(x) the linearization function and p(x) = p2(p1(x)) the processing function and the printing condition where p1(x) is the processing function, i.e. it defines the changes of tonal values on the plate before and after decoating, while p2(x) is given by the changes of tonal values on the print sheet starting from the values on the decoated plate. The function p1 is usually omitted for standard thermal plates. For processless plates p1(x) can be measured only after printing and we assume that p1(x) does not depend on run length or other influencing factors during the printing process. This might or might not be true. Anyway, we kept these factors stable during our tests. Note that the domain of p1 is of imaginary nature, since the latent image on the plate cannot be measured properly.

Then for standard thermal plates the requirement for linearization function l(x) is

$$l(x) = x, \text{ for all } x \in [0,100] \qquad (1),$$

whereas for process free plates we only can require

$$p1(l(x)) = x, \text{ for all } x \in [0,100] \qquad (2).$$

If the tonal values on the print sheets are varying during the production at a later point of time, the print provider usually exposes a tonal values wedge linearly, develops the plate and measures the values on the plate in order to determine whether the change has been caused by plate exposure/plate processing or by deviations in the printing process. If (1) still holds, changes must have been caused by the printing process. Has this modification be triggered by the platemaking (e.g. by declining the output of the laser diodes after a while), however, it suffices to set up a new linearization curve and one can keep all process calibration curves for the different printing substrates, screening types and printing units. If c(x) denotes the calibration curve and a(x) defines the target (aim) values, the c(x) must satisfy the equation

$$p(c(l(x))) = a(x), \text{ for all } x \in [0,100] \qquad (3).$$

This method of assigning deviation of tonal values in the actual print production to prepress or press, however, is no longer feasible with process free plates, since processing always includes the printing process already, i.e. we cannot establish l(x), but p1(l(x)) only after printing.

The objective of this work is to define a method for manual decoating of process free plates that yields to measurable and reproducible results. That is, a technique needs to be defined, so that such plates can be decoated by simple means, in particular without developing processor or a printing press. The method is supposed to be suitable in the context of quality assurance only (such as linearization, but also for setting the focus and energy levels of a platesetter or when checking the uniformity and consistency of the printing plate respectively of the imaging device) and is not intended for production. In this work, the focus was on two process free thermal plates from different manufacturers: The Kodak Sonora XP and the Fuji Brillia HD PRO-T3.

In practice, methods for decoating process free printing plates outside the printing press are already in use. For processing the Sonora XP different commercial glass cleaners are utilized, while for the Brillia HD Pro-T3 the Fujifilm gumming solution FN-6E is applied. In both cases, wiping movements are carried out on the plate with a sponge or rag with low pressure. After processing, the plate is cleaned with water to remove the residues of the stripping agent. These procedures pose the following two questions:

i. Are these methods consistent with respect to the tonal values, if several plates are decoated (by different people)?

ii. Do the tonal values on the plates match if the plates are processed manually/on a press?

Question (ii) can be re-stated: Is $p1(x)= m(x)$? Here $m(x)$ denotes the change of tonal values for some manual processing. If so, one can conclude from (2) that

$$m(l(x)) = x, \text{ for all } x \in [0,100] \quad (4),$$

which corresponds to equation (1). Equations (1) and (4) are essentially the same, they differ only in regard to the tonal value change during processing is added in (4) but omitted in (1).

Thus, only if both questions can be affirmed, one can define a classical linearization (1) or (4) with manually processed plates. For the above-discussed assessment whether a shift in tonal values is caused by the plate exposure or the printing process, however, it suffices if question (i) can be answered affirmatively for process free plates. The 1-1 mapping of nominal tonal values to those measured on the manually processed plate in equation (1) is not relevant. The decisive factor is the repeatability, i.e. the function $l(x)$ must be reproducible. In fact, for all offset plates the function $l(x)$ might depend on factors like the applied screening method or on the measuring device that is used. Still, normally just one linearization function per printing unit is established. Hence equation (1) is not valid in general and the notion "linearization" is not to be taken literally. When ripping data during production the tonal values are changed again anyway by the process calibration function $c(x)$ so that the aim values on the right-hand side of equation (3) comply with the requirements of ISO 12647-2. In short: $l(x)$ can be (almost) anything as long as it is reproducible.

3 Material and methods

Our test form contains common tonal value wedges with graduated tones of 5%, 10%, 20%, 30% ... 90%. The screening is defined by 70 lines per centimeter (175 l/inch) and no linearization function and process calibration curve are applied. These control strips are exposed on the Fuji Brillia HD PRO-T3 as well as on Kodak Sonora XP. After imaging, for some tests the plates are cut into small strips, which contain exactly one wedge each.

Manual processing of the Sonora XP was made by the use of a common glass cleaner and Brillia HD PRO-T3 was processed by the use of the gum solution FN-6E. For both plates different plate cleaners were tested, especially "Platten S" of DruckChemie and the gum solution "Star Plate Storage Gum ". For the metrological evaluation of tonal values on the printing plate, the plate image analyzer "SpectroPlate All-Vision" (firmware 5.07 / 10.21.2013) from the company Techkon GmbH was used. The printing plates were exposed on Heidelberger's "Suprasetter A105", the printing was done on a Speedmaster CD74.

4 Results

The following shows that questions (i) and (ii) can be affirmed only partly, when the above-mentioned manual processing methods are applied. Instead, a modified method is presented which fulfils the reproducibility (i) for both types of plates that were examined.

4.1. Testing procedure

First a sponge was moistened with water then a defined amount of one of the above-mentioned solutions was applied. Hereafter the sponge was rubbed for one minute with transverse and longitudinal movements on the plate. Hereby the color of the plate changed in the unexposed areas from a dark to a lighter gray.

This test was repeated several times under different conditions and by several people. The definition of the manual processing was specified more precisely as the tests went along. As mentioned above, the aim was primarily to achieve reproducibility, but also to check how close the tonal values that were measured on the manually processed plate came to those values, which were measured on the plates after printing. As a criterion for the first question the spans of the measurements were taken, which should be less than 2. As is stated in the ProcessStandard OFFset (PSO), the measured tonal values on a linearized plate should lie with a maximum distance of 1 from the target values (Belz, 2012). But, as discussed before, target values need not to be set. Just looking at the reproducibility, one can interpret this requirement of a span of 2. See also section "Prüfung von Gleichmäßigkeit und Konstanz der Druckplatte", where a maximal span of 2 is explicitly stated.

4.2. Evaluation

Figure 2 shows that the span of the tonal values measured on the manually processed Sonora XP (using common glass cleaner) and Brillia HD PRO T-3 (using gum solution FN-6E). The results show that Sonora XP does not fully comply to the required criterion (span under 2). On the other hand by Brillia HD PRO-T3 at all nominal tonal values the span is under 2. Nevertheless, as print houses use different chemicals including various gumming solutions and plate cleaner, additional solutions were examined for developing of investigated plates.

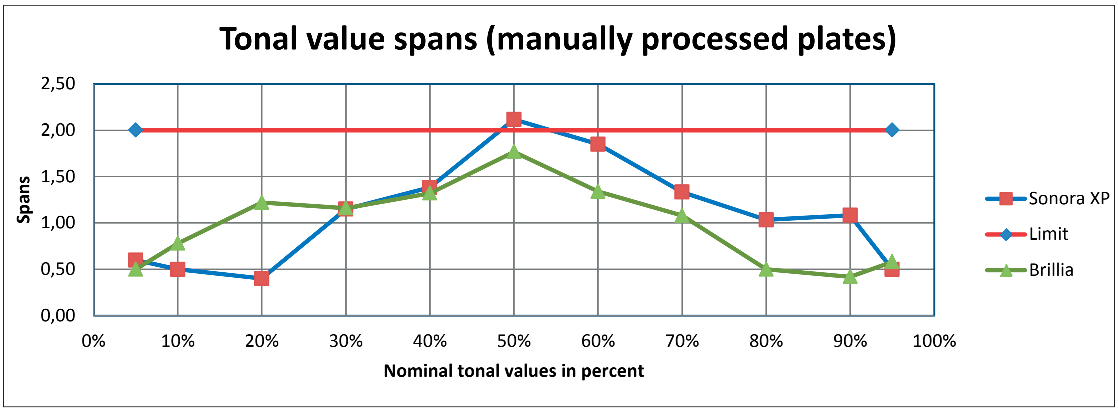

Figure 2: Span of tonal values on the plates manually decoated by different persons

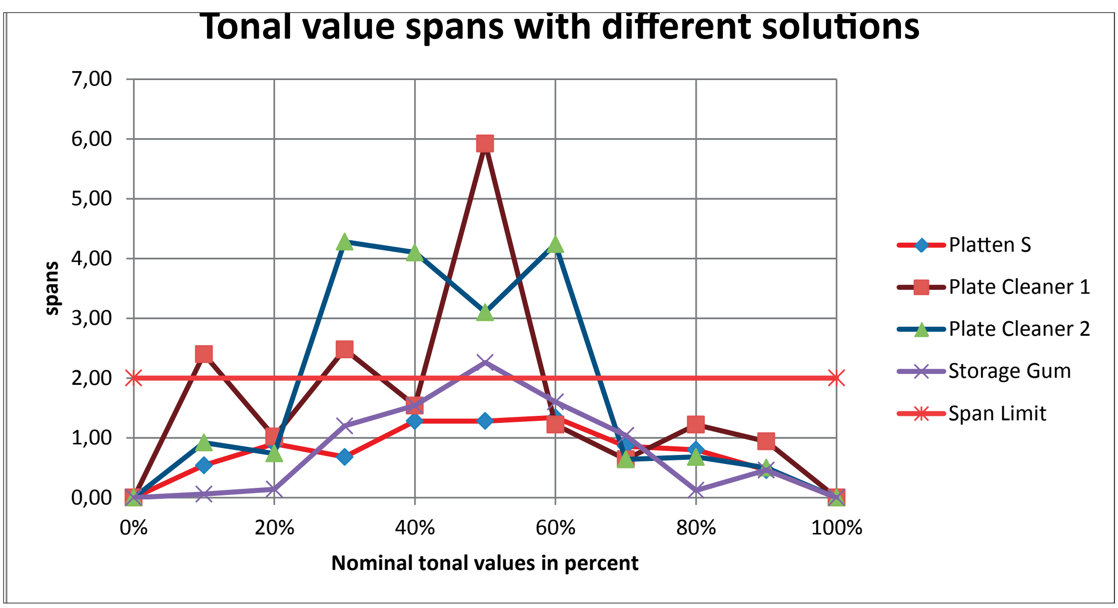

Figure 3: spans of tonal values on Sonora XP using different solutions

For the two types of plates 4 different plate cleaners (with or without abrasives) and gumming solutions were tested as decoating solutions. Only the results concerning the Sonora XP are presented here. As showed in figure 3, the span is below 2 as required only with the plate cleaner "Platten S" of DruckChemie . The tests were repeated several times and each tonal value patch was measured 5 times. For the Fuji Brillia HD Pro-T3, however, the gumming solution "Star Plate Storage Gum" showed the best results. Thus, further investigations were restricted to these two solutions.

The plate Sonora XP that has been decoated manually shows quite high TVI (almost 9% in the middle tone range), while the plate that has been decoated on press is almost linear (fig. 4). Thus, the above formulated question (ii) cannot be affirmed.

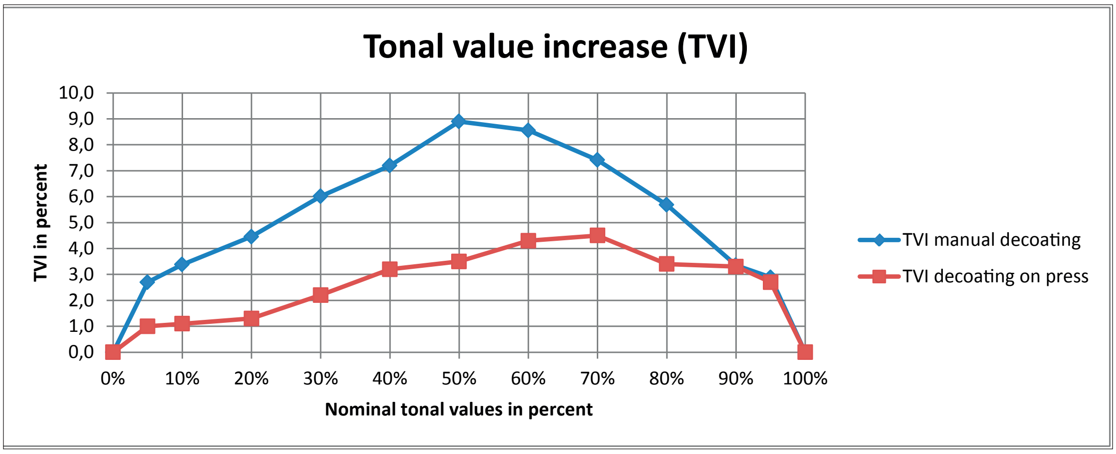

Figure 4: Difference in tonal values on manually decoated and machine decoated plates

For the test on repeatability seven persons decoated both process free plates manually following written instructions. It turned out that spans of the entire tonal range stayed below 2 for the Sonora XP as well as for the Brillia HD Pro-T3 and thus satisfied the requirements (fig. 5). The set time of 1 minute for the manual decoating seems to be crucial, because a longer period might change the tonal values.

The manual processing was finally applied for linearization of the Sonora XP (fig. 6). The maximum difference between the nominal and the measured tonal values on the linearized plate was 1.1%.

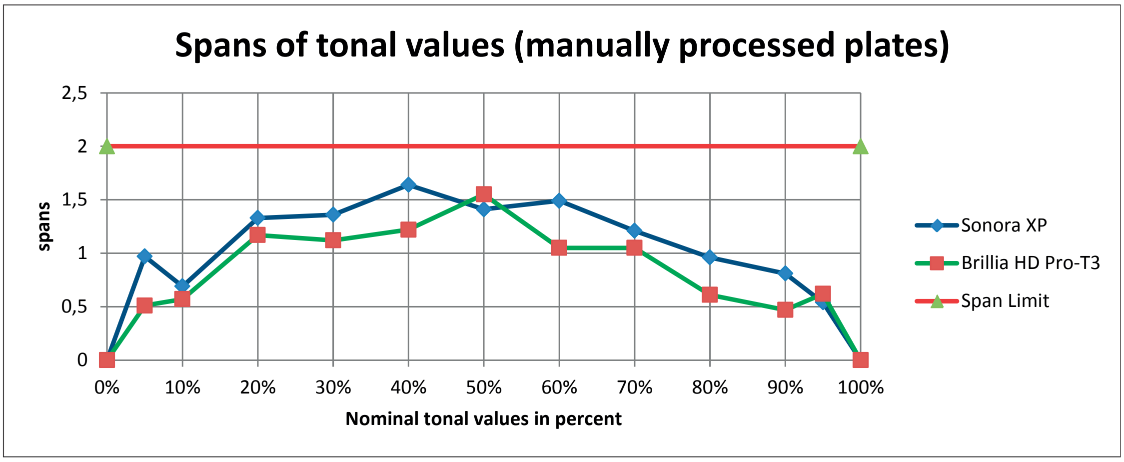

Figure 5: Span of tonal values below 2 when plates are decoated manually several times

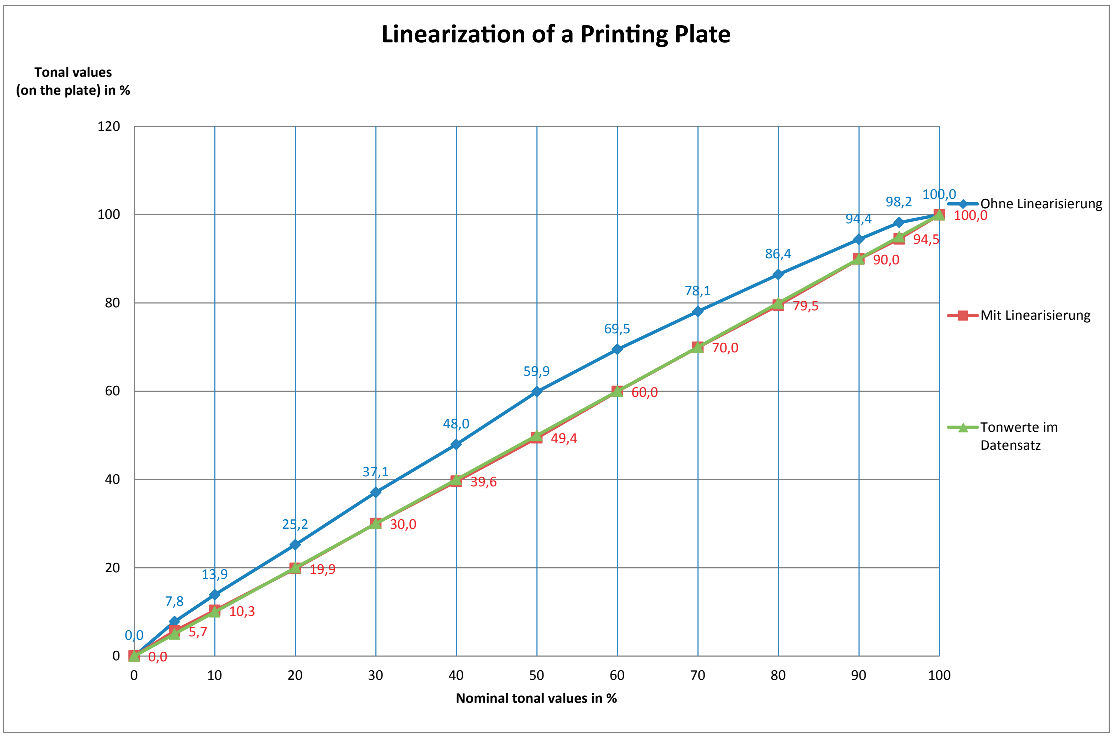

Figure 6: linearization curve is derived from the values on a manually decoated plate Sonora XP. The tonal values on the linearized plate match the nominal values closely

5 Conclusion and Discussion

From the results presented in this paper, one could conclude that the presented method for manual processing before printing in order to verify the linearity of the exposed plate seems to be more appropriate than the usual practice. This is especially true for the Sonora XP, since we obtained better results than with using glass cleaner. By the both plates, repeatable results were accomplished.

There are some limitations of this research. This method has been tried only in the laboratories of the Stuttgart Media University only. It still lacks a field test in which a larger number of experiments are carried out under different test conditions, e.g. with various imagesetters, presses and inks. It was examined whether the proposed method is independent of the persons who perform the decoating, but only with a very small number of subjects. The results obtained are promising, but not yet meaningful in a statistical sense.

With the obtained repeatability of the performed manual decoating, some other applications could be examined. In particular, the setting up of a plate for an imagesetter (energy and focus settings) and other quality assurance processes for plate imaging (uniformity of tonal values from plate to plate or within a plate) should be checked. Furthermore, a possible manual decoating of full plates in the actual production should be mentioned. Some users are, in fact, doing exactly that if they print many jobs with very short runs in a row, to make sure that the higher concentration of the decoated printing layer in the ink or in the fountain solution does not affect the printing process.

Furthermore, the question is still open, which chemical substances are precisely responsible for decoating. A potential interaction of focus and energy setting of the platesetter on the measured TVI on the plate should also be further explored.

Finally, a new processless plate came on the market within the investigation period, the ":Azura TE" of Agfa. This plate could no longer be considered in the present paper, but should also be analyzed for the requirements concerning quality control.

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