Grenoble, March 27th, 2019

Study Report n° 19.0083/1

Objet: Deinkability test and corresponding ERPC score

SAMPLES

Designation:
- Form test printed with SIEGWERK UV inks (LNRGY-LED)

Observations:
- Designation of tested product comes from the information given by SIEGWERK FRANCE. They do not engage CTP responsability
- Samples not used for deinking trials are stored in CTP for 3 months as well as samples generated during the trials

ORDER

V/ Ref: Quotation DV.FAB.19.0083/1

Customer: Jérôme FUMEX

Company: SIEGWERK FRANCE SA

TESTS

Recycling/deinking Team

Responsible for the tests: Benjamin FABRY

Visa

Main operator: Jean DE GRACIA

Calendar: Trials performed week 12

This report concerns only the tested products

The copy of this report is authorized in the uncut version only.

This report is made of 19 pages (including cover)

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SUMARY

Prints with UV inks are known to induce difficulties for deinking, mainly due to the generation of a high amount of dirt specks that are not sufficiently removed during flotation, leading to unacceptable cleanliness of the deinked pulp.

In this context, SIEGWERK is interested to determine the behaviour of their UV inks (LNRGY/LED process series) in terms of deinkability thanks to the ERPC deinkability score.

The tested print corresponds to Heidelberg Form test (see picture) printed simplex on **Lumi Art** (**100 g/m²** 72x52cm) from **Stora Enso** with **Heidelberg HD XL 75 LE/LED offset sheetfed press**. The UV inks correspond to **LNRGY/LED process series from SIEGWERK** and can be considered **with a good deinkability** according to the ERPC score obtained (99-100 pts). **This test score is also valid for printed products with the same or lower ink and varnish coverage and for the same paper with higher grammage.**

Compared to other UV inks products tested until now, the SIEGWERK LNRGY/LED series allows to generate dirt specks that are smaller in size after pulping stage, allowing then a better removal of them during flotation and reach the targeted values for A_{50} A_{250} criteria.

Besides, extrapolation (with some hypotheses that must be validated in practice) shows that if the print has been printed in duplex, the good deinkability would have been maintained.

1. Context and objectives

The presence of ink particles coming from printed papers is considered as detrimental particles in Paper for Recycling that must be removed to produce new white papers for the graphic chain (newspapers, magazines, printing/writing, etc). Ink removal step is mainly achieved during flotation in deinking mills. Flotation is based on the particle size and the hydrophobic character of the particles to be removed. In order to evaluate the deinkability of a product, a laboratory method has been developed: method INGEDE 11 quantifies the deinkability results through optical properties obtained after defined laboratory deinking sequence as well as process parameters such as ink removal and coloration of the process water.

In order to be awarded for EU Ecolabel for printed paper or Blue Angel, the product put on the market must answer to a number of criteria including recyclability issue that includes proven deinkability for the printed products. For this purpose, “Deinking Scorecard” can be used. The deinking scorecard was adopted by the European Recovered Paper Council (ERPC) to promote eco-design of printed products; which will ensure their recyclability and also promote sustainable processes. In France, in the framework of declaration of prints put on the market, a given number of troublemaker elements on deinking/recycling have been identified and can be submitted to penalty. Among these troublemaker elements, UV inks and UV varnishes are brought to the fore. In order to be exempted of penalty during declaration to CITEO, it is necessary to justify the deinkability of the product put on the market (ERPC deinkability score higher than 70 points). Until now, all the UV inks printed products failed ERPC deinkability score due to too high dirt speck content after lab deinking sequence.

SIEGWERG company is interested to determine the deinking potential of their UV inks. It can be advanced that good deinkability of them has been reported recently [1].

2. Characteristics of printed product

The tested print corresponds to Heidelberg Form test printed simplex on Lumi Art (100 g/m² 72x52cm) from Stora Enso. The UV inks correspond to LNRGY/LED process series from SIEGWERK. The form test is illustrated in Figure 1.

The complete information on the prints are given in Annex - Information given by SIEGWERK (p.14).

Figure 1: Printed samples.

[1] Glasser T., Hengesbach P. “UV/LED deinking – ready for a greener printing”, *INGEDE Symposium*, Munich, 13 February 2019, p. 35-43

3. Trial description and ERPC deinking score principle

3.1. Laboratory deinking test: INGEDE method 11

The complete description of INGEDE method 11 (January 2018 version)) is described in the following link: http://www.ingede.org/ingindxe/methods/meth-e.html.

The print samples are firstly artificially aged in an oven during 72 hours at 60°C and then manually shredded into pieces of about 2x2 cm² and acclimated. The ash content of the prints is also determined. As ash content is higher than 20%, the pulping stage was performed at fibre consistency of 12%

In a first step, dry papers are reslushed at 15% mass consistency with the conventional chemistry recommended by INGEDE method 11 (0.6% NaOH, 1.8% silicate, 0.7% H_2O_2 and 0.8% oleic acid) in order to determine if the pH range of INGEDE method 11 are respected or not, and to eventually adjust eventually the chemical dosage to achieve the pH targets. After the trials, the pH range was higher than 10, therefore, the chemistry was adapted with less alkaline conditions (0.4% NaOH and 1.2% silicate). A new pulper was then performed with this condition and the pH achieved was acceptable.

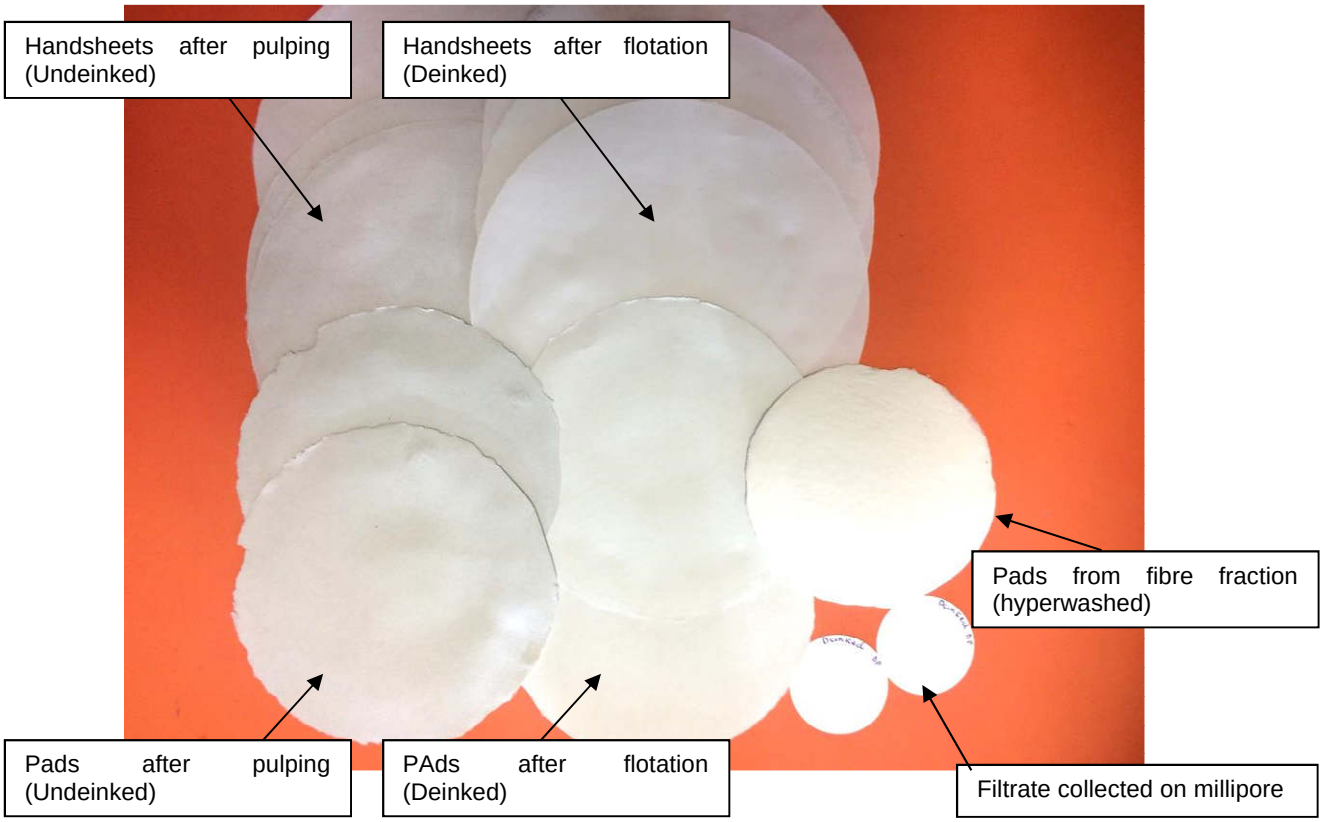
The re-slushed pulp is then diluted to 5% consistency and stored at 45°C during 60 minutes. The pulp is then diluted a second time at 8 g/l for flotation in a Voith Delta 25L cell during 12 min with air supply at 7L/min. The foam generated is collected and used to determine the flotation yield.

During all these steps, the water hardness is adjusted to 128 mg Ca^{2+}/l.

Pictures of the different steps are illustrated in the following figures (note that pictures do not correspond to the tested prints but are present to illustrate the different steps).

Figure 2 : Illustration of the different steps.

Pulp samples are collected and used to manufacture pads, handsheets, collect water from thickening, etc. All the preparations of samples are made in agreement with the various INGEDE methods to be applied.



3.2. Principle of ERPC deinkability score

"Assessment of Printed Product Recyclability – Deinking Score" [2] proposed by the European Recovered Paper Council can be applied to determine their recyclability. The latter document provides an assessment of the deinkability of a printed product by evaluating results of a laboratory deinking test procedure for all kinds of printed graphics on white paper. The deinkability of a printed product, as a whole, can be assessed by only looking at its Deinkability Score (max score of 100). For individual products, this is done by using the rating of the results given in this specification or by comparing the Deinkability Scores of several printed products. Scoring are determined according to the INGEDE method n°11p [3] that defines the procedure and equipment to be used to run a deinkability test. Deinkability is assessed by 3 quality parameters (luminance, color shade and dirt specks (in two different categories) and 2 process parameters (ink elimination and filtrate darkening).

For each of these parameters, thresholds and target values are defined. The target values are depending on the category of the printed product. If the results meet the target value or are better, it scores the maximum points allocated to this parameter. If it is not the case, the score has to be

[2] ""Assessment of printed product recyclability: deinkability score Issue 2 – January 2017" by European Recovered Paper Council – document available at http://www.paperrecovery.org/uploads/Modules/Publications/WithAnnexAssessment%20of%20printed%20product%20recyclabilitywebview-3.pdf
[3] INGEDE Method n°11p " Assessment of Print Product Recyclability: Deinkability test", available at www.ingede.de/ingindxe/methods/meth-e.html

calculated: for each individual parameter, the ratio of units better than the threshold value, divided by the range between threshold and target values, multiplied by the maximum score for this parameter gives the Deinkability Score for this parameter. If one result does not reach the threshold value, a negative score is attributed and the corresponding print product will be classified as not suitable for deinking. Note that a score below zero in one or more parameters leads to an overall assessment "not suitable for deinking".

The list of output parameters and used abbreviations are the following:

- Y: luminance of deinked pulp measured by the reflectance at 557 nm expressed in percent
- a*: color shade (green or red) in CIE L*a*b* system
- A_{50} : dirt particle area for particles larger than 50 µm (circle equivalent diameter) expressed in mm²/m²
- A_{250}: dirt particle area for particles larger than 250 µm (circle equivalent diameter) expressed in mm²/m²
- IE: Ink elimination expressed in %
- ΔY: filtrate darkening expressed in points

The weighting of each parameters (and therefore the maximum score), threshold values and target values are given in the following table (for the tested product, target values to be applied correspond to the “Magazine coated” case). If the test failed at least one criterion (and whatever the score obtained for the other criteria), the print is considered as not suitable for deinking. On the other, as soon as a print passes all the threshold values for all the parameters, a deinkability score can be attributed: it corresponds to the sum of the score of each parameter and allows to classify them in terms of deinkability (Table 2).

Parameter	Y	a*	A_{50}	A_{250}	IE	ΔY
Maximum score	35	20	15	10	10	10
Threshold values						
Lower Threshold	47	-3.0			40	
Higher Threshold		2.0	2 000	600		18
Target values according to the product category						
Newspaper	>60	>-2.0 to <+1	<600	<180	> 70	< 6
Magazines, uncoated	>65				> 70	
Magazines, coated	>75				> 75	
Stationary (Y of base paper <75)	>70				> 70	

Table 1: Maximum score, threshold values and target values for each parameter for “Newspapers”, “Magazine” and “Low Ink coverage products (Brightness of base paper <75”.

As soon as a Deinking Score is established, printing products recyclability should be assessed according to the following table. The deinking score is then valid only for an association of paper/ink/printing process. Any change of this association can lead to different behaviour.

Score	Evaluation of deinkability
71 to 100 points	Good
51 to 70 points	Fair
0 to 50 points	Tolerable
Negative (failed to meet at least one thresehold)	Not suitable for deinking (May be recyclable without deinking)

Table 2: Rating of the deinkability score

4. Results

All the data are reported in Annex - Data from INGEDE method 11 (p.16)

4.1. Presence/removal of pigmented black inks

The ERIC measurements (Effective Residual Ink Content) allow to follow black inks not visible by naked eyes but that impact strongly brightness and luminosity of the pulp. This measurement is based on reflectance measurement at 950 nm (wavelength where only pigmented black inks will have an impact):

- Measured on whole pulp after pulping, ERIC gives indication on the initial amount of ink and/or the fragmentation of them: the higher the ERIC value, the greater the amount of ink present and/or the higher the ink fragmentation level.
- Measured on hyperwashed pulp (lab procedure allowing to remove all the particles smaller than 65µm and referenced fibre fraction), ERIC values give information on the amount of ink still attached to the fibres. It also gives us the potential of deinkability if all the free inks are removed
- Measured on whole pulp after flotation, ERIC values give information on the amount of ink removed by flotation (flotation process does not induce ink fragmentation) and therefore the total ink removal index and the detached ink removal index (also called free ink removal).

Based on the ERIC measurements, it is possible to determine different indexes:

- Ink detachment index: $Id=(1-ERIC_{hyperwashed}/ERIC_{pulper\ outlet})x100$
- Total ink removal index: $IE_{ERIC}=(1-ERIC_{floated\ pulp}/ERIC_{pulpeur\ outlet})x100$
- Free ink removal index: $IE_{free}=[1-(ERIC_{floated\ pulp}-ERIC_{hyperwashed})/(ERIC_{pulpeur\ outlet}-ERIC_{hyperwashed}]x100$

When determining the deinkability score, the preconized Ink Elimination calculation is based on the reflectance measurement at 700 nm (IE_{700}). In comparison to the previous method based on ERIC (Reflectance at 950 nm), IE_{700} takes into account a part of the dyes, the nature of the fibres, the presence of mineral filler.

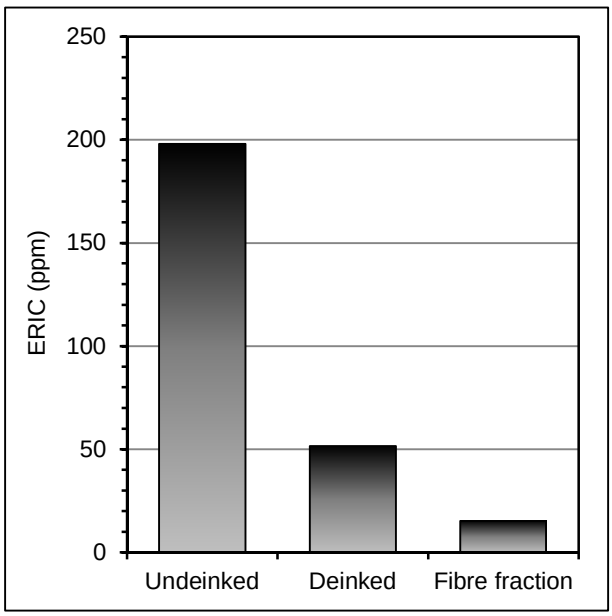


Figure 3 : ERIC measurements after pulping, flotation and on fibre fraction.

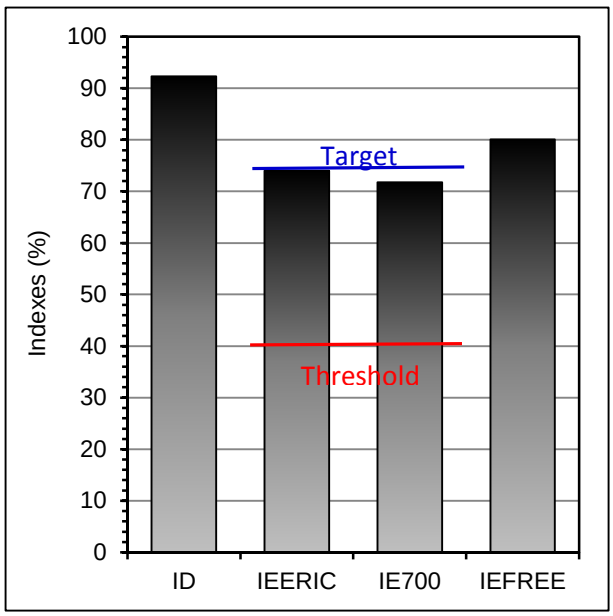


Figure 4 : Ink detachment and ink removal indexes.

After pulping stage the ERIC value represents ~200 ppm that can be viewed as relatively low value in regards to the ink coverage applied during printing. This relatively low value should be relevant of particles that are relatively big (even if not visible) compared to conventional offset inks. During this pulping stage, the residual ink on the fibre represents only 15 ppm: logically, the ink detachment from the fibres is high (>90%) for a coated paper.

During flotation, the ERIC decreases then to 50 ppm that represents roughly 75% reduction in ink content (the free ink removal during flotation represents ~80%). If the ink removal index is based on R_{700nm}, the ink removal index is slightly lower with 72% but in the same magnitude than IE_{ERIC} (slightly below the targeted value for such print product). In any case, both indexes are largely higher than the threshold value.

4.2. Brightness and luminance Y

Even if brightness is not taken into account in ERPC deinkability score, it is one of the key parameter for paper production and use for the printer. Brightness is measuFigure 6Figure 6red at 457 nm wavelength and in the framework of this study with C2° light source (UV excluded). After pulping, the brightness is already high (69%). After flotation where ink has been removed, brightness gains are logically observed (11 points). The increase in brightness due to ink removal is clearly illustrated in Figure 6: the lower the ERIC (the lower the ink content), the better the brightness. After flotation, the brightness represents 80 pts whereas the fibre fraction (i.e. after removal of all the fine elements including cellulosic fine, mineral filler and residual inks particles) represents ~87 pts.

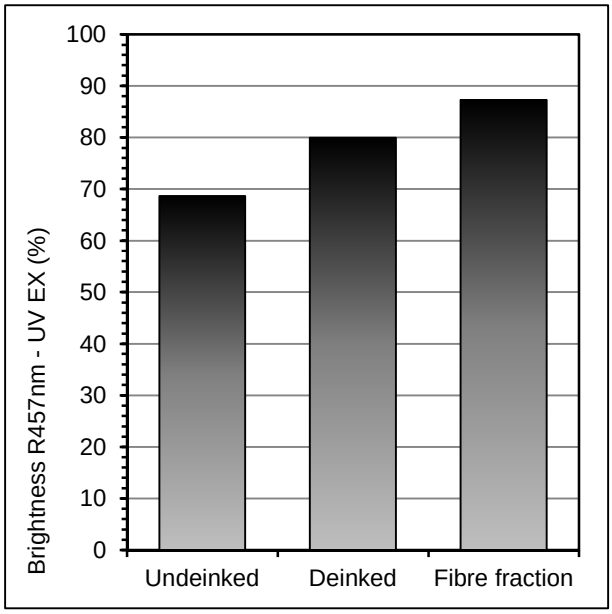


Figure 5 : Brightness after pulping, flotation and on fibre fraction.

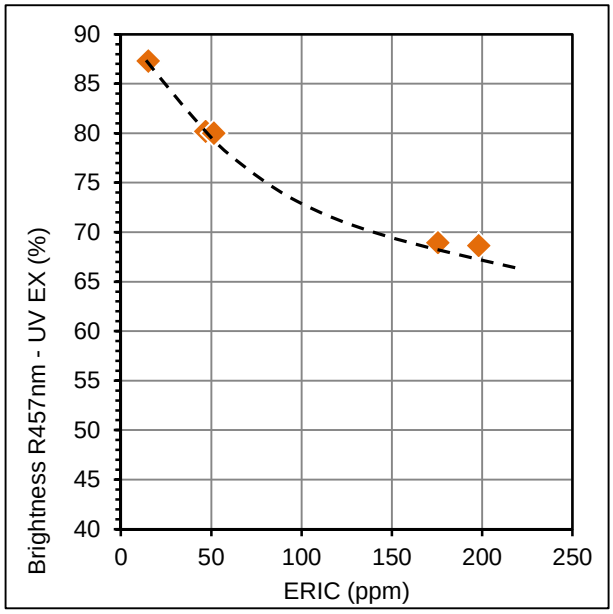


Figure 6 : Brightness versus ERIC measurements.

Luminance Y (based on reflectance measured at 557 nm wavelength, contrary to brightness based on reflectance at 457 nm), follows the same trend than brightness. After pulping stage, the luminance already reaches ~70 and is increased up to 82 points after flotation. As for brightness, a typical relationship illustrated in Figure 8 can be observed: the lower the ink content (i.e. the lower the ERIC), the better the luminance development.

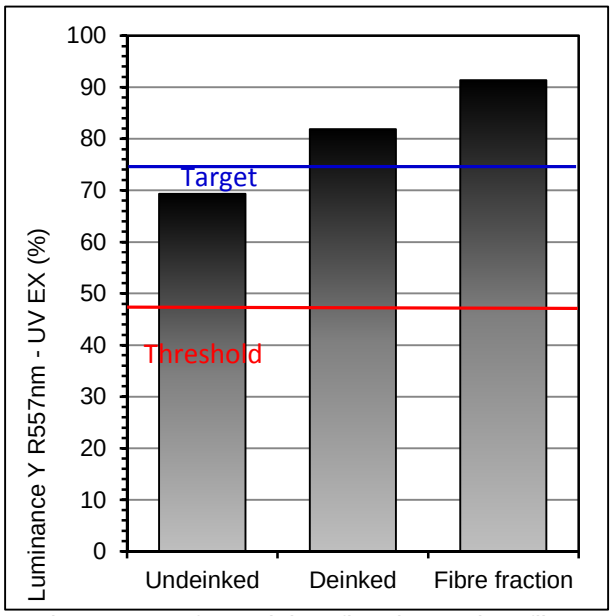


Figure 7 : Y after pulping, flotation and on fibre fraction.

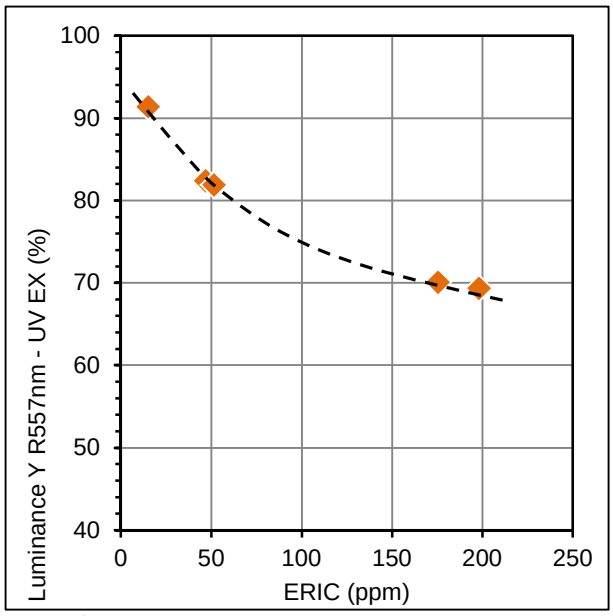


Figure 8 : Y versus ERIC measurements.

4.3. Residual color shade

Residual color shade of the pulp is measured through L*a*b* CIE system:

- L*=0 corresponds to black and L*=100 corresponds to perfect white. The intermediates values correspond then to different grey level.
- a* is characteristic of red shade (if positive value) or green shade (if negative value)
- b* is characteristic of yellow shade (if positive value) or blue shade (if negative value).

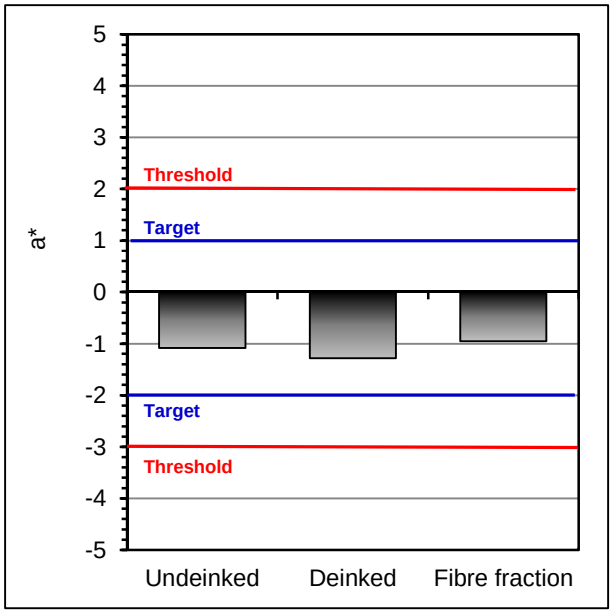


Figure 9 : Green/red shade.

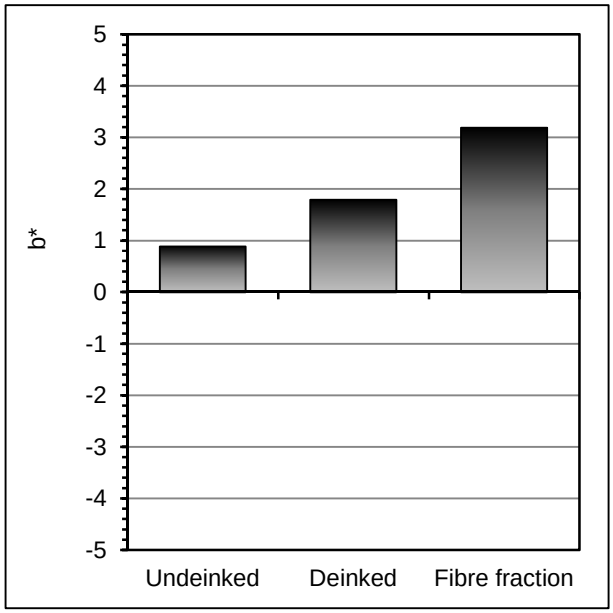


Figure 10 : Blue/Yellow shade.

The pulps obtained during the various steps of INGEDE method 11 are characterized by slight green shade but under an acceptable range within the targeted window.

Even if only a* is taken into account in the determination of ERPC deinkabiility score, b* value can also give information on the nature of the fibres, the presence of blue or yellow inks. As illustrated in Figure 10, an increase in yellow shade is observed along the various steps (the fibre content is higher and higher, so that yellow shade of fibres are more and more revealed).

4.4. Dirt specks (A_{50} and A_{250})

Dirt speck particles correspond to large particle of ink having an equivalent diameter greater than 50 µm (and visible by naked eyes). The total dirt speck contamination A_{50} (i.e. all the particles having an equivalent diameter larger than 50 µm) is expressed in mm²/m² of handsheets is very high after pulping stage even if the print is simplex: it represents contamination > 20 000 mm²/m² that is far away from the threshold and targeted values. Thanks to flotation, 98% of the dirt specks are removed allowing to reach a final contamination of 375 mm²/m², meaning that the targeted value has been reached.

For the largest particles having a diameter larger than 250 µm, the same trend is observed: the contamination after pulping represents 1 400 mm²/m² that is reduced to 100 mm²/m² after flotation thanks to 93% removal of them during this step, meaning that the targeted value for this A_{250} criterion is achieved.

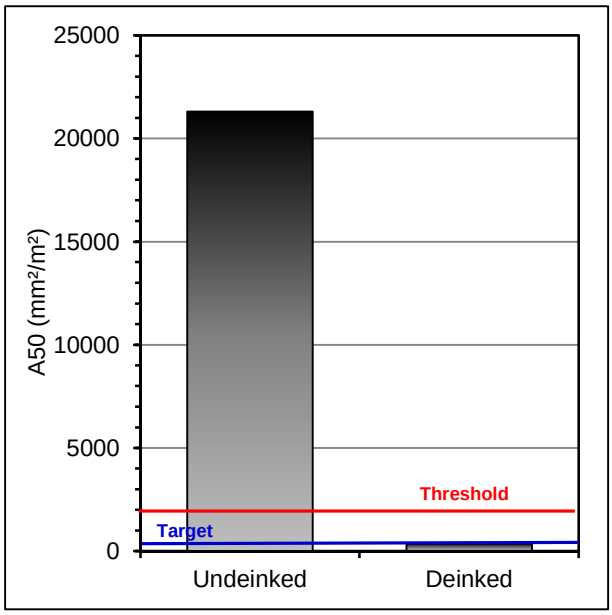


Figure 11 : Total dirt speck contamination (A_{50}).

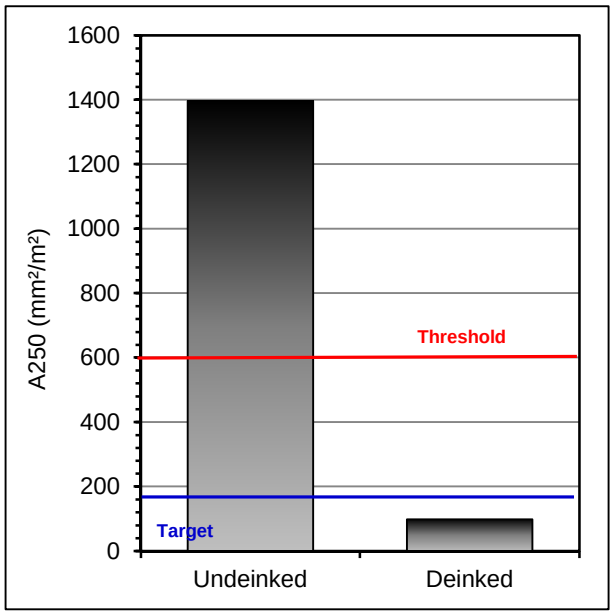
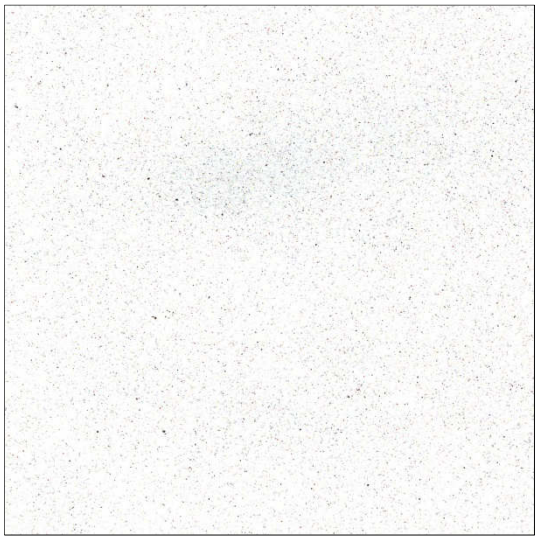
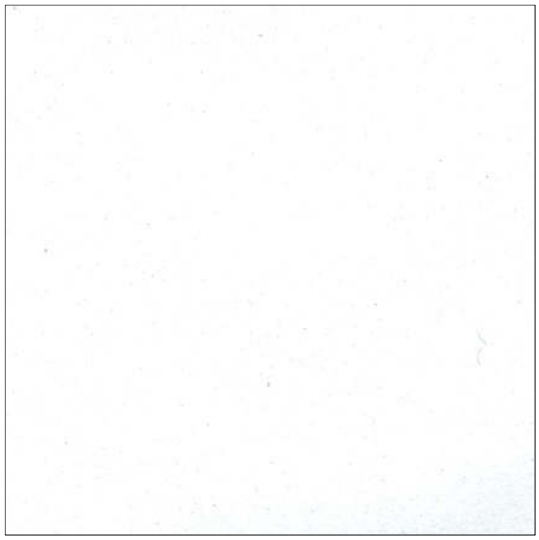


Figure 12 : Largest dirt specks contamination (A_{250}).

The great improvment in reduction in dirt speck contamination is clearly illustrated in the two following scan of the handsheets (real size of scanned pictures : 5x5 cm)



Undeinked pulp (after pulping)



Deinked pulp (after flotation)

Several comments can be advanced:

- The largest particles are logically more difficult to remove by flotation (the optimal size range for flotation being smaller than 250 µm). Indeed, particles with equivalent diameter between 50 and 250 µm are removed with 99% efficiency whereas particles with diameter higher than 250 µm are removed with 93% efficiency.
- The mean equivalent diameter after pulping (~150 µm) can be considered as low for UV inks (300-600 µm range is more typical for such inks) but they are in a size range more favorable for removal by flotation, allowing to explain the good results obtained with the NRGY/LED inks from SIEGWERK.
- For UV inks, dirt speck contamination after pulping is conventionally in the range of 40 000 to 50 000 mm²/m²; i.e. the double compared to the simplex print tested.

4.5. Filtrate darkening

Process water coloration (also called filtrate darkening) is measured by filtration on Millipore of 100 ml of filtrate obtained during thickening of 4 g o.d. in 1 litre of water through filter paper) is as expected very low for UV inks : ΔY~1pt (the targeted value of 6 is largely achieved).

4.6. Flotation yield

Even if not directly taken into account in ERPC deinkability score, flotation yield is an important parameter for deinkers as it will have a direct impact on environmental footprint and deinking cost production (yield is associated with solid losses that are generated during flotation). For coated paper, the total yield is generally higher than 70%. As mentioned in INGEDE method 11, if the fibre yield is below 65%; the test must be repeated with a shorter flotation time to reach 65%. For the print product tested;

- The overall yield represents 68.5% that is low value but still acceptable
- The fibre yield is 88%, meaning repetition of the test with shorter flotation time is not necessary.

4.7. ERPC deinkability score

4.7.1. ERPC deinkability score of the tested product (simplex)

The following tables summarize the useful results to calculate the ERPC deinkability score:

- In green (👍👍), it corresponds to measurement where the tested product reached the targeted value, meaning that it will obtain the maximum score for this parameter
- In black (👍), it corresponds to measurement within the targeted and threshold values.
- In red (👎), it corresponds to measurement where the tested product does not reach the threshold value. If only one of the parameter failed, by application of the ERPC deinkability score principle, the product is considered as not suitable for deinking, whatever the score obtained for the other criteria.

For the print tested, all the criteria are respected as illustrated in Table 3, meaning that a deinkability score can be calculated (remark, if only one 👎, it won't have been the case) and is given in Table 4. Depending on the Ink Elimination index considered (IE_{ERIC} or IE_{R700}), the total ERPC deinkability score is between respectively 100 and 99 points, meaning that the tested print product can be considered with a good deinkability.

Parameter	Y [pts]	a* [-]	A_{50} [mm²/m²]	A_{250} [mm²/m²]	IE [%]	ΔY [pts]
Threshold, target and measured values						
Lower threshold	47	-3.0			40	
Higher threshold		2.0	2 000	600		18
Target value	>75	>-2.0 to <+1	<600	<180	>75	<6
Tested product	👍👍	👍👍	👍👍	👍👍	👍👍 / 👍	👍👍

Table 3: Criteria respect for each parameters.

Parameter	Y [pts]	a* [-]	A_{50} [mm²/m²]	A_{250} [mm²/m²]	IE [%]	ΔY [pts]
Threshold, target and measured values						
Lower threshold	47	-3.0			40	
Higher threshold		2.0	2 000	600		18
Target value	>75	>-2.0 to <+1	<600	<180	>75	<6
Tested product	**82**	**-1.3**	**375**	**100**	**74-72**	**1**
Deinkability score (details)						
Maximum score	35	20	15	10	10	10
Tested product IE based on R700nm	**35**	**20**	**15**	**10**	**10-9**	**10**

Table 4: Details of the EPRC score.

4.7.2. Anticipated ERPC deinkability score for a duplex print product

If the print is printed in duplex (with the same form test), it can be estimated that

- The final dirt speck contaminations (A_{50} and A_{250}) will be multiplied by a factor 2
- The ERIC value after flotation will be multiplied also by a factor 2. Thanks to the relationship between luminance Y and ERIC (Figure 8), the Y after flotation could be estimated to 74 points
- Filtrate darkening, Ink Elimination and color shade would be unchanged

In that case, the corresponding ERPC deinkability score would be about 96 pts, meaning that it would be considered as a print product with good deinkability. This score is only anticipated and is based on several hypotheses that need to be verified.

5. Conclusions

The tested print corresponds to Heidelberg Form test (see picture) printed simplex on **Lumi Art** (**100 g/m²** 72x52cm) from **Stora Enso** with **Heidelberg HD XL 75 LE/LED offset sheetfed press**. The UV inks correspond to **LNRGY/LED process series from SIEGWERK** and can be considered **with a good deinkability** according to the ERPC score obtained (99-100 pts). **This test score is also valid for printed products with the same or lower ink and varnish coverage and for the same paper with higher grammage [4].**

Compared to other UV inks products tested until now, the SIEGWERK LNRGY/LED series allows to generate dirt specks that are smaller in size after pulping stage, allowing then a better removal of them during flotation and reach the targeted values for A_{50} A_{250} criteria.

Besides, extrapolation (with some hypotheses that must be validated in practice) shows that if the print has been printed in duplex, the good deinkability would have been maintained.

[4] Typically for the assessment of print product recyclability in the case of the EU Ecolabel licencing and similar (including R&D purpose), it is not always possible or appropriate to provide a genuine print product for testing. A generic test can therefore be performed on reference products. Results of the assessment for the reference product will be valid for all related print products bearing the same features as the tested reference product, i.e. the same technical data and material combination with the same or lower ink coverage (for each ink). The related printed products will therefore not require further laboratory deinking test procedures.

6. Annex

6.1. Information given by SIEGWERK

INGEDE

Assessment of deinkability
Data sheet

Please specify if choosing "other" (use the field remarks)
Grey fields are filled in by INGEDE Office

Number of questionnaire	
Receipt date	
INGEDE TestID	
Applicant	
Company	Siegwerk
Street	13 route de Taninges
Postal code	74100
City	Annemasse
Country	FR
Contact name	Fumex Jérôme
Phone	450877400
Mobile	686452487
Fax	
e-Mail	jerome.fumex@siegwerk.com
General Information	
Product Name	**forme test Heidelberg**
Publisher	Siegwerk
Issue	mai-18
Printing Plant	
Print run	1000 sheets
Publishing frequency	Anual
Weight in g	
Pages	

Product Part	**Please select**
No. of Pages	
Paper	
Furnish	Woodfree
Finishing	HWC
Use	Offset (uncoated/coated)
Manufacturer	Stora Enso
Brand name	Lumi Art
Basis weight in g/m²	100.0
Brightness R_{457}	99.0
Printing Technology	
Printing process	Offset Sheetfed
Printing fed	Sheet-fed
Printing machine manufacturer	Heidelberg
Printing machine designation	HD XL 75 LE/LED
Printing process speed	13000 s/h
Ink	
Cyan	
Position of printing unit	2
Trade name	LNRGY/LED Process Cyan
Manufacturer	Siegwerk
Manufacturer article number	70-120994-2
Main Carrier	Other
Magenta	
Position of printing unit	3
Trade name	LNRGY/LED Process Magenta
Manufacturer	Siegwerk
Manufacturer article number	70-802375-9
Main Carrier	Please select
Yellow	
Position of printing unit	4
Trade name	LNRGY/LED Process Yellow
Manufacturer	Siegwerk
Manufacturer article number	70-301069-4
Main Carrier	Please select
Black	
Position of printing unit	1
Trade name	LNRGY/LED Process Black
Manufacturer	Siegwerk
Manufacturer article number	70-900825-4
Main Carrier	Please select
Image setting	
Colour management	On
Fountain solution	
Manufacturer	Eggen
Concentration in %	3.0
Drying	
Technology	UV curing
Temperature in °C	
Post-treatment	
Varnish	No treatment
Other	
Remarks	**Test performed on a LED / LE press**

6.2. Data from INGEDE method 11

	Unit	SIEG Results / Data
General		
Product Name		**FORM TEST (Simplex)**
Additional Product Info		UV inks from SIEGWERK
Category of Printed Product		Test Print
Type of Printed Product		Magazine
Issue		
Date of Print (if n/a: Date of Issue)		May 2018
Date of Test		19/03/2019
Number of Tests		1
Category of Print		Test
Country of Printing		
Part of Product		Other
Printing Process		Offset Sheetfed
Paper		
General Paper Classification		Coated
Paper Furnish		Woodfree
Paper Finishing		HWC
Paper Use		Offset (uncoated/coated)
Paper Basis Weight	[g/m²]	100
Brightness of Unprinted Paper (low ink coverage products)	%	
Ash Content (525 °C)	%	43.9
Laboratory Test Procedure		
Method Used		INGEDE Method 11:2012-08
Chemical Dosage		
Sodium Hydroxide	%	0,4
Sodium Silicate	%	1,2
Hydrogen Peroxide	%	0.7
Oleic Acid	%	0.8
Pulping Concentration	%	15.0
Flotation Cell		Voith Delta 25
Flotation stock concentration of undeinked pulp	%	0.80
Flotation feed mass of undeinked pulp	kg	22.5

	Unit	Results / Data
General		
Product Name		**FORM TEST (Simplex)**
Additional Product Info		UV inks from SIEGWERK
Laboratory Results		
pH Values		
After Pulping (15% Concentration)		9.6
At Begin of Storage (5% Concentration)		9.0
At End of Storage (5% Concentration)		8.8
At Begin of Flotation (Flotation Concentration)		8.2
Yield		
Flotation Yield	%	68.5
Fibre Yield	%	87.8
Overflow		
Mass m_{froth}	kg	1.49
Stock concentration	g/kg	38.06
Undeinked Pulp		
Ash Content (525 °C)	%	43.9
Brightness R457 Filter Pad	%	68.7
Illumination C/2°/0 without UV		
Y Filter Pad		69.3
L* Filter Pad		86.7
a* Filter Pad		-1.1
b* Filter Pad		0.9
R_∞, 700 Filter Pad	%	69.8
ERIC Filter Pad	ppm	198.2

	Unit	Results / Data
General		
Product Name		**FORM TEST (Simplex)**
Additional Product Info		UV inks from SIEGWERK
Laboratory Results		
Deinked Pulp		
Ash Content (525 °C)	%	28.1
Brightness R457 Filter Pad	%	80.0
Illumination C/2°/0 without UV		
Y Filter Pad		81.9
L* Filter Pad		92.5
a* Filter Pad		-1.3
b* Filter Pad		1.8
R_{∞}, 700 Filter Pad	%	82.6
ERIC Filter Pad	ppm	51.6
Dirt Particle Area: Domas		
Total Count	#/m²	21 464
Count: >50 - 100	#/m²	477
Count: >100 - 150	#/m²	17 266
Count: >150 - 200	#/m²	1 781
Count: >200 - 250	#/m²	869
Count: >250 - 500	#/m²	939
Count: >500	#/m²	133
Total Area	mm²/m²	375
Total Area >250	mm²/m²	99
Area: >50 - 100	mm²/m²	3
Area: >100 - 150	mm²/m²	197
Area: >150 - 200	mm²/m²	42
Area: >200 - 250	mm²/m²	34
Area: >250 - 500	mm²/m²	70
Area: >500	mm²/m²	29

	Unit	Results / Data
General		
Product Name		**FORM TEST (Simplex)**
Additional Product Info		UV inks from SIEGWERK
Laboratory Results		
Deinked Pulp Filtrate Illumination C/2°/0 without UV		
Brightness R457 Membrane Filter	%	92.7
Y Membrane Filter		94.3
L* Membrane Filter		97.8
a* Membrane Filter		-0.7
b* Membrane Filter		1.3
R∞, 700 Membrane Filter	%	
Type of flocculant		-
Flocculant volume	ml	-
Control Water Illumination C/2°/0 without UV		
Brightness R457 Membrane Filter	%	95.6
Y Membrane Filter		95.5
L* Membrane Filter		98.3
a* Membrane Filter		-0.2
b* Membrane Filter		0.0
R∞, 700 Membrane Filter	%	95.1
Reference		
Reference (e.g. Project)		FAB.19.0083
Institute		
Institute		CTP
Technician		de gracia
Calculated Results		
IE700, Filter Pad	%	71.8
IEERIC, Filter Pad	%	74.0
ΔY Filtrate		1.2
General Remarks		

Benchmarking Category		Magazine Coated
Y	DS	**35**
a*	DS	**20**
$A_{>50}$	DS	**15**
$A_{>250}$	DS	**10**
IE	DS	**9**
ΔY	DS	**10**
Total Scoring	Total Assessm.	**99.0** **good deinkability**

Calculation according to ERPC:
Assessment of Print Product Recyclability
– Deinkability Score –
Version 3.3.4 (January 2017)