

# Decentralized innovative treatment of ammonium-rich urban wastewater

## The Portuguese case



**citeve**

TEXTILE TECHNOLOGY

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*CITEVE*

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# Textile & Clothing industry in Portugal - Geographic distribution

## Cotton sector companies

Home textiles, cotton-based fabrics and knitted fabrics

Outdoor and indoor clothing

Ropes and nets

## Knitted products

Production and sewing of Knitwear garments

## Clothing manufactures

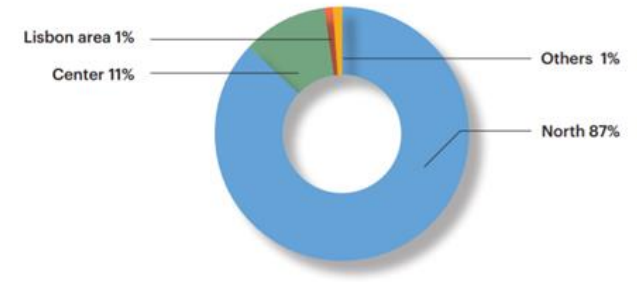
Synthetic fibres manufacturing companies



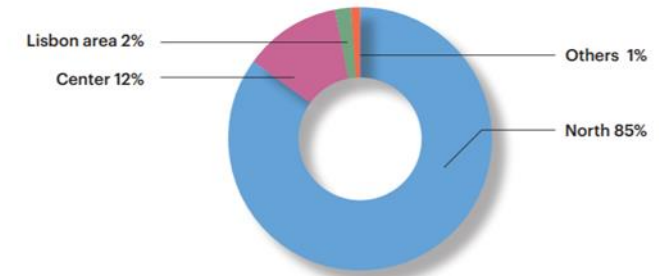
## Wool sector Companies

Wool-based yarns, fabrics and knitted fabrics  
Sewing companies of outdoor garments

Production by Region *Produção por Região*



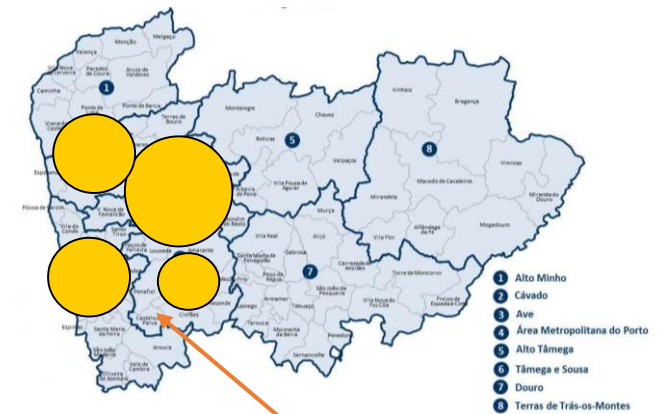
Turnover by Region *Volume de Negócios por Região*



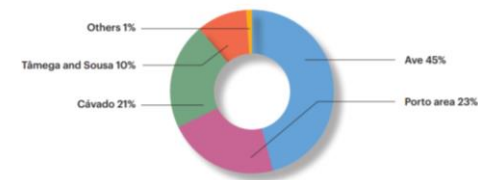
Source: [https://atp.pt/wp-content/uploads/2019/06/18d40e\\_05b733596d234696a52afe170e848901.pdf](https://atp.pt/wp-content/uploads/2019/06/18d40e_05b733596d234696a52afe170e848901.pdf)

# Textile printing - Geographic distribution

- The **North of Portugal** is a very important region for the **Textile Industry**, where the most small and medium textile companies are located.
- This region is characterized as being the **Cotton Sector**, where the companies produce home textiles, finished fabrics and knitted fabrics, cotton-based and its blends with synthetic fibres, i.e PES, PA, etc.
- Textile Finishing processes, in particular **Digital Textile Printing**, have a big importance for this region.
- Most of Textile Finishing Companies (**around 80%**) do **not treat the wastewater on site**, and the **effluents** are discharged in a **public system of Wastewater Treatment**.

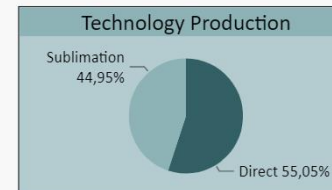
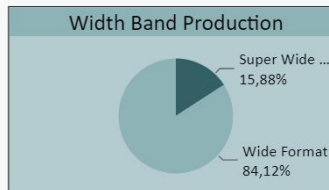
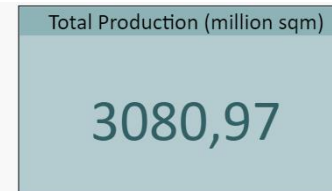
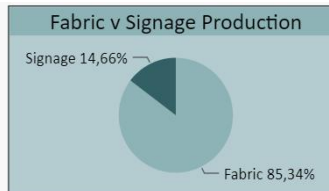
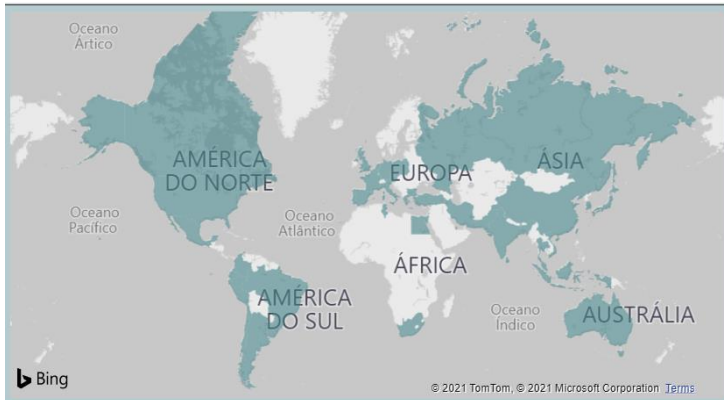


Turnover in the North Region *Volume de Negócios na Região Norte*



# Digital textile printing market - Portugal

Source: WTiN – 2019 data



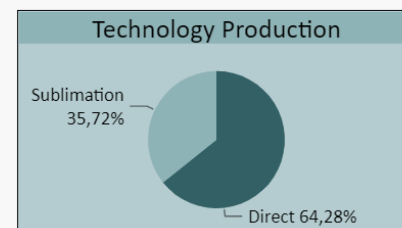
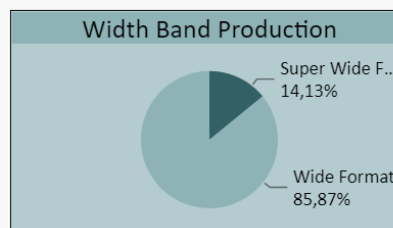
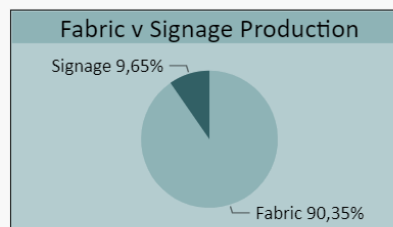
This is around 3% of the total digital production in the world

Europe

Portugal

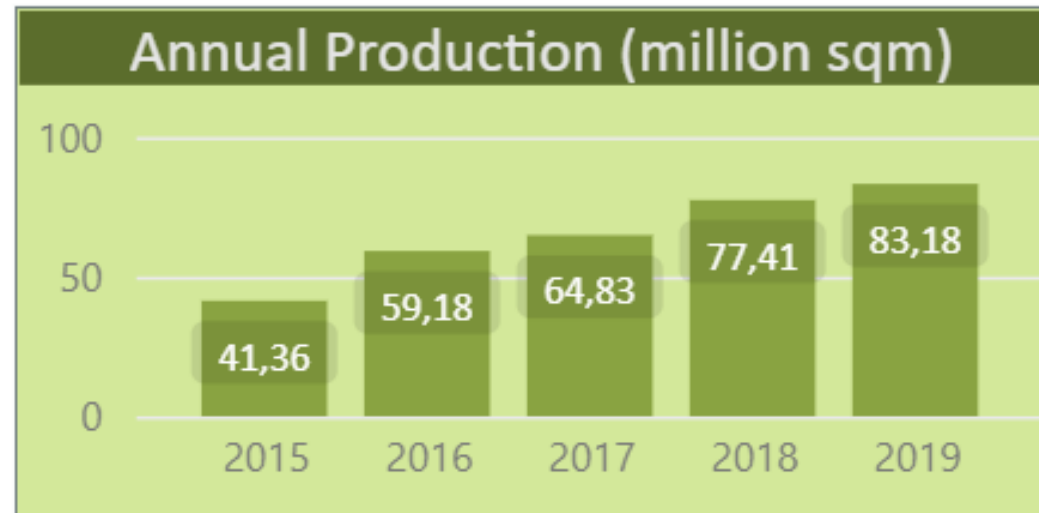
2019

Portugal



# Digital textile printing market - Portugal

Source: WTiN – 2019 data



- **Digital Textile Printing** market in Portugal **showed a high growth rates** in the last six years.
- Sublimation transfer has a high installed technological base in Portugal and continues to be widely used in a wide range of applications (fashion, sportswear, soft signage).
- However, **Direct Digital Printing** has been growing at a high rate in recent years in Portugal.

# The Portuguese case

- **Textile printing** companies are generally **integrated** in the **finishing sector** which also include dyeing and finishing processes, **thus is difficult to separate** the **printing effluent** from the others.
- Portugal has around **500** textile finishing companies (dyeing, printing and finishing processes).
- Around **25%** of textile finishing sector **perform printing** (traditional and digital printing).
- Portugal has around **20** textile companies with DTP (direct printing), and with around **45** digital printing machines (not included printing paper for sublimation), producing effluent containing **high levels of nitrogen**.
- Data allows to estimate that in less than 3 years, almost textile finishing factories in Portugal will adopt DTP and more companies may appear on the market.
- Average annual wastewater discharged from single **finishing** company ranges from: **107 000 to 695 000 m<sup>3</sup>/year**.
- Around **80%** of these companies do not treat the wastewater on site, and the effluents are discharged in a **public System of Wastewater Treatment**. The remaining **20%** discharge the effluent **directly on river** after on site treatment.
- However, no data is available on the total volume discharged by the industries of DTP.

# The Portuguese case – Discharge limits

Parameters	Direct discharged to the environment	Indirect discharge
	Limits are defined by the Decree-law (DL236/98)	(Limits defined by WW Management Systems: SIDVA; City Council of Barcelos,....)
pH	6,0 – 9,0	5,5 – 9,5
BOD <sub>5</sub> (mg/l O <sub>2</sub> )	40	500
COD (mg/l O <sub>2</sub> )	150	2000; 1000
TSS (mg/l)	60	1000
Total Nitrogen (mg/l N)	15	----
Ammonium (mg/l NH <sub>4</sub> )	---	100 (SIDVA)
Total Phosphorous (mg/l P)	10	----

- So far, **Nitrogen** content of wastewater is **not considered a big problem** for wastewater management systems, most of them **don't have limits for Total Nitrogen** (one of them has a limit for the ammonium);
- For companies with direct discharge to the environment, **Total Nitrogen** values are used to calculate the **discharge fee**.

# The Portuguese case – Partners companies

Parameters of effluent discharged	Company 1 (100% DTP)	Company 2 (70% TP and 30% DTP )+ Dyeing and Finishing
Annual average of effluent discharge (m <sup>3</sup> /year)	145 970 m <sup>3</sup> /year	374 000m <sup>3</sup> /year
Daily average of effluent discharge (m <sup>3</sup> /day)	450,7m <sup>3</sup> /day	1570m <sup>3</sup> /day
Monthly average that the company pays for the effluent discharge	12 952€/month	19800€/month
Mean time that the liquid effluent remains in the homogenization tank	Around 4- 6 hours/day	Around 24 hours/day
<b>Final Effluent: Average TKN (mg/l N)</b>	<b>420</b>	<b>85</b>
<b>Total mass of nitrogen discharged (Total N load = TNL = average N concentration x annual volume of discharge)</b>	Total mass of nitrogen discharged = 61 307 400 mg	Total mass of nitrogen discharged = 31 790 000 mg
<b>Specific nitrogen load = SNL = TNL/number of employees (total)</b>	SNL =61 307 400/118 = 519 554 mg/ employees	SNL =31 790 000/ 317 = 100 283,9 mg/employees



# Portuguese case - Conclusion

- Taking into account the information gathered during the audits to the Portuguese companies and the previous results from the wastewater characterization, we conclude that wastewaters from DTP Portuguese companies have a **high content of nitrogen**.
- With the growing of digital textile printing, it is expected that authorities and wastewater management systems are going to face the problem of wastewater nitrogen content tightening the regulations.
- Considering the two Portuguese companies partners in this study, the results obtained from **TKN** were very **promising** to be treated by **Anammox technology** and gave us an idea of what wastewater will be in the future of textile printing associated with the increase of digital printing technology.
- Based on the results from **physicochemical characterizations**, **biological activity** tests performed and on the **requirements for the success of nitrogen removal** through PN/Anammox technology, we can conclude that the two selected effluents can be successfully treated with the **PN/Anammox process**.

# Thank you

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