PB85-116143

Dyebath Reuse Saves Money and Reduces Pollution

Sverdrup and Parcel and Associates, Inc.
St. Louis, MO

Prepared for

Industrial Environmental Research Lab.
Research Triangle Park, NC

Oct 84

U.S. Department of Commerce
National Technical Information Service
NTIS

PB85-116143

EPA-600/M-84-002
October 1984

DYEBATH REUSE SAVES MONEY AND REDUCES POLLUTION

by

Jon Bergenthal - Project Manager
Sverdrup & Parcel and Associates
St. Louis, Missouri

John Eapen - Corporate Environmental Manager
Bigelow Sanford, Inc.
Greenville, South Carolina

Anthony Tawa - Project Engineer
Sverdrup & Parcel and Associates
St. Louis, Missouri

Dr. Wayne Tincher - Professor
Georgia Institute of Technology
Atlanta, Georgia

EPA Contract 68-02-3678

EPA Project Officer
Robert V. Hendriks

INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/M-84-002	2.
3. RECIPIENT'S ACCESSION NO. PB85 116143	
4. TITLE AND SUBTITLE: Dyebath Reuse Saves Money and Reduces Pollution	5. REPORT DATE: October 1984
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): J. Bergenthal, J. Eapen (Bigelow Sanford, Inc.), A. Tawa, and W. Tincher (Georgia Tech)	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Sverdrup and Parcel and Associates, Inc. 801 North Eleventh St. Louis, Missouri 63101	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO. 68-02-3678
12. SPONSORING AGENCY NAME AND ADDRESS: EPA, Office of Research and Development Industrial Environmental Research Laboratory Research Triangle Park, NC 27711	13. TYPE OF REPORT AND PERIOD COVERED: Journal article; 4/81-12/83
	14. SPONSORING AGENCY CODE: EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert V. Hendriks, MD-63, 919/541-3928.

16. ABSTRACT

The article discusses an evaluation of the potential for wastewater recycle or reuse in textile finishing mills. Over a dozen recycle technologies were evaluated in six separate mills. Results of these preliminary studies showed that most of the recycle technologies were technically feasible, but only a few were cost effective: synthetic size recovery and reuse, caustic recovery and reuse, direct wastewater reuse (e.g., countercurrent washing), and direct dyebath reuse. The last-mentioned was singled out for further study because it was seen as having several advantages: low capital cost for implementation, substantial processing cost savings, significant environmental benefits, and the potential for widespread use in the industry. It is estimated that about half of all textile dyeing is performed by batch operations, including most knit fabric, hosiery, and yarn, along with substantial amounts of carpet and some woven fabric. Dyebath reuse technology was first developed by the Georgia Institute of Technology about 10 years ago, but few mills have adopted it to date.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Pollution Control	13B
Textile Finishing	Stationary Sources	13H
Dyeing	Dyebaths	
Waste Water	Recycling	
Water Treatment		
Circulation		14G

18. DISTRIBUTION STATEMENT: Release to Public	19. SECURITY CLASS (This Report): Unclassified	21. NO. OF PAGES: 8
	20. SECURITY CLASS (This page): Unclassified	22. PRICE

EPA Form 2220-1 (9-73)

NOTICE

Between 1981 and 1983, the U.S. Environmental Protection Agency sponsored a project to evaluate the potential for wastewater recycle or reuse in textile finishing mills. Over a dozen recycle technologies were evaluated at six separate mills.

The results of these preliminary studies showed that most of the recycle technologies were technically feasible, but only a few were cost effective: synthetic size recovery and reuse, caustic recovery and reuse, direct wastewater reuse (e.g., countercurrent washing), and direct dyebath reuse.

Direct dyebath reuse was singled out for further study under the EPA Project. It was seen as having several advantages: low capital cost for implementation, substantial processing cost savings, significant environmental benefits, and the potential for widespread use in the industry.

It is estimated that about half of all textile dyeing is performed by batch operations, including most knit fabric, hosiery, and yarn, along with substantial amounts of carpet and some woven fabric. Dyebath reuse technology was first developed by the Georgia Institute of Technology about ten years ago, but few mills have adopted it to date.

EXPERIMENTS AT BIGELOW-SANFORD

A series of dyebath reuse experiments was conducted during the summer of 1983 at Bigelow's laboratories in Greenville, South Carolina. Two grades of nylon carpet along with six shades for each grade were selected for these bench-scale experiments.

Five batches of each shade were dyed from the same bath and the shade matching results checked. Further tests were done in which the batches dyed from the same bath gradually progressed from light to dark shades. The tests showed that successful shade matching could be achieved with dyebath reuse.

Much valuable experience was gained in these experiments with the techniques needed to analyze an exhausted dyebath and reconstitute it for the next dyeing. The only special equipment required was a simple visible-light spectrophotometer, calculator and some laboratory glassware. A desk-top (home) computer was used later instead of a calculator to simplify and automate the dyebath analysis procedure.

Following these initial experiments, several pilot-scale dyeings were performed to verify the results of the bench-scale experiments. Shade matching and color fastness tests were again satisfactory.

FULL-SCALE DEMONSTRATION

A week-long plant demonstration of dyebath reuse was conducted at Bigelow's Summerville, Georgia plant. A temporary pump and piping arrangement was set up for the demonstration.

At the end of a dyeing, the exhausted dyebath was pumped to an adjacent beck already loaded with carpet for the next dyeing. The dyed carpet in the first beck was rinsed and pulled in the normal fashion. Meanwhile, a sample of the exhausted dyebath was analyzed and the computer quickly printed out the amounts of dyes and chemicals to add for the next dyeing.

The same two grades of nylon carpet that were used in the bench- and pilot-scale experiments plus some additional shades from these carpet grades were selected for the full-scale dyeings. As many as ten batches were dyed with the same dyebath during this demonstration. All the dyeings were first quality, and were done without any adds or redyes above normal requirements.

The amounts of water, dyes, chemicals, and steam used in the dyeings were carefully recorded. The savings for a typical dye cycle are shown in Table 1. Based on these savings, a yearly savings of $30,000 is projected for each beck on which dyebath reuse is installed.

COSTS

The capital cost for permanently installing dyebath reuse at two of the plant's dyebecks is about $80,000. This includes a pump; a 6,000 gallon dyebath storage tank; associated piping, valves and controls; and the dyebath analysis equipment noted above.

Yearly operating costs are estimated to be $5,000, with yearly savings of $60,000 for two becks. This results in a payback period of about 1½ years. The prospects for reducing the payback period even further are good. Many areas exist for optimizing the dyebath reuse process, thereby increasing the chemical and energy savings.

ENVIRONMENTAL BENEFITS

Samples of dyeing wastewater were taken from both conventional dyeings and reuse dyeings. The samples were compared, and the results are shown in Table 2.

Not only does dyebath reuse result in cost savings from water, chemical, and energy savings, but it also reduces the amount of wastewater and pollutants discharged. Dyebath reuse, along with other types of wastewater recycle, can be a more cost-effective approach to reducing pollution than waste treatment.

USERS MANUAL

A manual describing the concepts and procedures for reusing dyebaths was produced as part of this project. With this manual, a textile mill can evaluate and test dyebath reuse on its own. Detailed descriptions of needed equipment items and their use are given, and a computer program for dyebath reuse is presented. The detailed results of the studies at Bigelow-Sanford are also included in a separate volume. Both volumes of the report are available from NTIS.

Footnote: Although this project was funded in part by the U.S. Environmental Protection Agency under contract number 68-02-3678, this article has not been subjected to the Agency's peer review and therefore no official Agency view or endorsement should be inferred.

TABLE 1

DYEBATH REUSE COST SAVINGS

Item	Cost Savings Dollars/Cycle	Cost Savings vs. Conventional Dyeing
Dyes	$ 0.03	1%
Chemicals	18.58	35%
Water/Sewer	4.70	36%
Energy	5.33	$< 10\%$
TOTAL	$28.64 per cycle	

TABLE 2

ENVIRONMENTAL BENEFITS OF DYEBATH REUSE

Pollutant	Reduction in Discharge From Dyebath Reuse
Flow	34%
BOD	33%
COD	33%
Dissolved Solids	43%