CHAPTER 4

RESULT

4.1 DETERMINATION OF % DYE UPTAKES FOR VARIOUS DYES

The % dye uptakes of polypropylene tape yarn dyed with seven disperse dyes, namely, foue azo dyes and three anthraquinone dyes, in the presence of three carrier concentrations (i.e., 0, 2 and 5 g/l) at various temperatures (i.e., 90, 110 and 130 °C) are determined. Since two dyes, i.e., C.I. Disperse Brown 1, and C.I. Disperse Violet 8, are found having almost no affinity for the tape yarn, all the % dye uptakes in any condition of dyeing are described as zero. The results for other five dyes are shown in Table 4.1(A) - 4.3(E).

Table 4.1 Dye uptakes (%) for various disperse dyes at 90 °C

(A) C.I. Disperse Orange 3

Dye weight used	10.225	mg
Dye purity	57.40	%
Initial pure dye used	5.869	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9944	5.902	0.281	4.761
2	1.0023	5.855	0.296	5.055
5	1.0026	5.854	0.249	4.253

(B) C.I. Disperse Red 1

Dye weight used	10.350	mg
Dye purity	73.23	%
Initial pure dye used	7.579	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9988	7.588	0.175	2.306
2	0.9971	7.601	0.333	4.381
5	0.9962	7.608	0.242	3.181

(C) C.I. Disperse Orange 5

Dye weight used	9.550	mg
Dye purity	51.05	%
Initial pure dye used	4.875	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9954	4.897	0.074	1.511
2	0.9926	4.911	0.348	7.086
5	0.9976	4.887	0.140	2.865

(D) C.I. Disperse Violet 28

Dye weight used	9.825	mg
Dye purity	90.83	%
Initial pure dye used	8.924	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9927	8.990	0.119	1.324
2	0.9994	8.929	0.766	8.579
5	0.9878	9.034	2.266	25.083

(E) C.I. Disperse Red 60

Dye weight used	10.325	mg
Dye purity	85.11	%
Initial pure dye used	8.788	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9921	8.858	0.858	9.686
2	0.9992	8.795	2.109	23.979
5	0.9980	8.806	1.131	12.843

Table 4.2 Dye uptakes (%) for various disperse dyes at 110°C

(A) C.I. Disperse Orange 3

Dye weight used	10.150	mg
Dye purity	57.40	%
Initial pure dye used	5.826	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	1.0002	5.825	0.192	3.296
2	0.9964	5.847	0.332	5.678
5	0.9932	5.866	0.396	6.751

(B) C.I. Disperse Red 1

Dye weight used	9.975	mg
Dye purity	73.23	%
Initial pure dye used	7.305	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9982	7.318	0.460	6.286
2	0.9943	7.347	0.487	6.629
5	1.0004	7.302	0.525	7.190

(C) C.I. Disperse Orange 5

Dye weight used	9.975	mg
Dye purity	51.05	%
Initial pure dye used	5.092	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g)	INITIAL DYE /TAPE RATIO (mg/g)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g)	DYE UPTAKE (%)
	(2)	(3)=(1)/(2)	(4)	(5) =(4)*100/(3)
0	0.9864	5.162	0.228	4.417
2	1.0006	5.089	0.407	7.998
5	1.0014	5.085	0.433	8.515

(D) C.I. Disperse Violet 28

Dye weight used	9.925	mg
Dye purity	90.83	%
Initial pure dye used	9.015	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g)	INITIAL DYE /TAPE RATIO (mg/g)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g)	DYE UPTAKE (%)
	(2)	(3)=(1)/(2)	(4)	=(4)*100/(3)
0	1.0016	9.001	0.294	3.266
2	0.9990	9.024	1.471	16.301
5	0.9982	9.031	3.064	33.928

(E) C.I. Disperse Red 60

Dye weight used	10.050	mg
Dye purity	85.11	%
Initial pure dye used	8.554	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9990	8.563	2.986	34.871
2	0.9992	8.561	2.587	30.218
5	1.0007	8.548	1.952	22.836

Table 4.3 Dye uptakes (%) for various disperse dyes at 130°C

(A) C.I. Disperse Orange 3

Dye weight used	9.975	mg
Dye purity	57.40	%
Initial pure dye used	5.726	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	1.0011	5.720	0.214	3.741
2	0.9991	5.731	0.321	5.601
5	1.0003	5.724	0.480	8.386

(B) C.I. Disperse Red 1

Dye weight used	9.925	mg
Dye purity	73.23	%
Initial pure dye used	7.268	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	1.0010	7.261	0.389	5.357
2	1.0004	7.265	0.396	5.451
5	1.0004	7.265	0.540	7.433

(C) C.I. Disperse Orange 5

Dye weight used	10.000	mg
Dye purity	51.05	%
Initial pure dye used	5.105	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)*	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	1.0005	5.102	0.267	5.233
2	1.0015	5.097	0.380	7.455
5	1.0009	5.100	0.513	10.059

(D) C.I. Disperse Violet 28

Dye weight used	10.075	mg
Dye purity	90.83	%
Initial pure dye used	9.151	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	1.0000	9.151	0.484	5.289
2	1.0013	9.139	2.313	25.309
5	1.0006	9.145	2.917	31.897

(E) C.I. Disperse Red 60

Dye weight used	9.975	mg
Dye purity	85.11	%
Initial pure dye used	8.490	mg...(1)

CARRIER CONC. (g/l)	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE /TAPE RATIO (mg/g) (3)=(1)/(2)	FINAL DYE ADSORBED/ TAPE RATIO (mg/g) (4)	DYE UPTAKE (%) (5) =(4)*100/(3)
0	0.9998	8.492	4.008	47.197
2	0.9983	8.504	2.712	31.891
5	1.0015	8.477	2.457	28.984

4.2 THE STUDY OF EFFECTS OF TEMPERATURE AND CARRIER CONCENTRATION

The dyeings of polypropylene tape yarn with C.I. Disperse Red 60 in the presence of various carrier concentrations, i.e., 0, 1, 2, 3, 4 and 5 g/l at various temperatures, i.e., 70, 80, 90, 100, 110, 120 and 130 °C are studied. The results of % dye uptake are shown in Table 4.4(A) - 4.4(G).

Table 4.4 Dye uptakes (%) for dyeing with C.I. Disperse Red 60

Dye weight used	10	mg
Dye purity	85.11	%
Initial pure dye used	8.511	mg.....(1)

(A) at 70 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	1.0002	8.509	0.112	0.120	1.316	1.410	1.363
1	0.9998	8.513	1.434	1.419	16.845	16.669	16.757
2	0.9998	8.513	0.614	0.630	7.212	7.400	7.306
3	1.0000	8.511	0.396	0.396	4.653	4.653	4.653
4	0.9992	8.518	0.274	0.290	3.217	3.405	3.311
5	1.0000	8.511	0.233	0.234	2.738	2.749	2.743

(B) at 80 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	1.0000	8.511	0.347	0.347	4.077	4.077	4.077
1	1.0000	8.511	1.888	1.888	22.183	22.183	22.183
2	0.9994	8.516	1.336	1.336	15.688	15.688	15.688
3	1.0000	8.511	0.987	0.987	11.597	11.597	11.597
4	1.0000	8.511	0.769	0.752	9.035	8.836	8.935
5	1.0000	8.511	0.598	0.590	7.026	6.932	6.979

(C) at 90 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	0.9997	8.513	0.825	0.817	9.691	9.597	9.644
1	0.9999	8.512	2.351	2.359	27.620	27.714	27.667
2	1.0002	8.509	2.032	2.040	23.881	23.975	23.928
3	0.9998	8.513	1.702	1.701	19.993	19.981	19.987
4	1.0001	8.510	1.409	1.401	16.557	16.463	16.510
5	1.0002	8.509	1.091	1.077	12.822	12.657	12.739

(D) at 100 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	0.9999	8.512	1.612	1.612	18.938	18.938	18.938
1	1.0000	8.511	3.103	3.103	36.459	36.459	36.459
2	1.0000	8.511	2.398	2.398	28.175	28.175	28.175
3	1.0001	8.510	2.122	2.122	24.935	24.935	24.935
4	0.9999	8.512	1.857	1.864	21.816	21.898	21.857
5	1.0000	8.511	1.539	1.531	18:082	17.988	18.035

(E) at 110 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	1.0000	8.511	2.949	2.949	34.649	34.649	34.649
1	1.0000	8.511	3.538	3.535	41.570	41.534	41.552
2	1.0000	8.511	2.560	2.560	30.079	30.079	30.079
3	1.0000	8.511	2.366	2.366	27.799	27.799	27.799
4	1.0000	8.511	2.163	2.171	25.414	25.508	25.461
5	0.9998	8.513	1.944	1.936	22.836	22.742	22.789

(F) at 120 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	1.0000	8.511	4.254	4.254	49.982	49.982	49.982
1	0.9999	8.512	3.355	3.355	39.415	39.415	39.415
2	0.9999	8.512	2.584	2.584	30.357	30.357	30.357
3	0.9998	8.513	2.494	2.495	29.296	29.308	29.302
4	0.9999	8.512	2.293	2.293	26.938	26.938	26.938
5	1.0000	8.511	2.155	2.155	25.320	25.320	25.320

(G) at 130 °C

CARRIER CONC. USED	INITIAL TAPE YARN USED (g) (2)	INITIAL DYE/TAPE RATIO (mg/g) (3) =(1)/(2)	DYE ADSORBED/ TAPE RATIO (mg/g) (4)		DYE UPTAKE (%) (5)=(4)*100/(3)		
			1	2	1	2	Ave
0	1.0000	8.511	4.017	4.019	47.198	47.221	47.209
1	1.0001	8.510	3.484	3.484	40.940	40.940	40.940
2	1.0001	8.510	2.722	2.714	31.986	31.892	31.939
3	1.0000	8.511	2.649	2.648	31.124	31.113	31.118
4	1.0000	8.511	2.479	2.477	29.127	29.103	29.115
5	0.9998	8.513	2.471	2.471	29.026	29.026	29.026

4.4 ASSESMENT OF LIGHT FASTNESS (24)

The final light fastness assessment in numerical ratings is based on contrast (change in color) equal to grey scale grade 2 between exposed and unexposed portions on the specimen. The light fastness specimen, dyed with C.I. Disperse Red 60 at 120 °C without carrier and possessing the highest % dye uptake on it after dyeing, is 3-4 which is described as moderate fastness to fair fastness.