浄水処理実験 実験レポート

03250114 大隅伸明

目的

上水実験課題では以下の項目を扱い、浄水処理の物理化学的な原理について定性的・定量的な両面から理解を深めることを目的とする。

1. オゾンによる有機物分解
2. a
3. a
4. 凝集沈殿における最適条件の決定
5. 消毒
    1. 塩素消毒
    2. 紫外線消毒

課題 A オゾンによる有機物分解

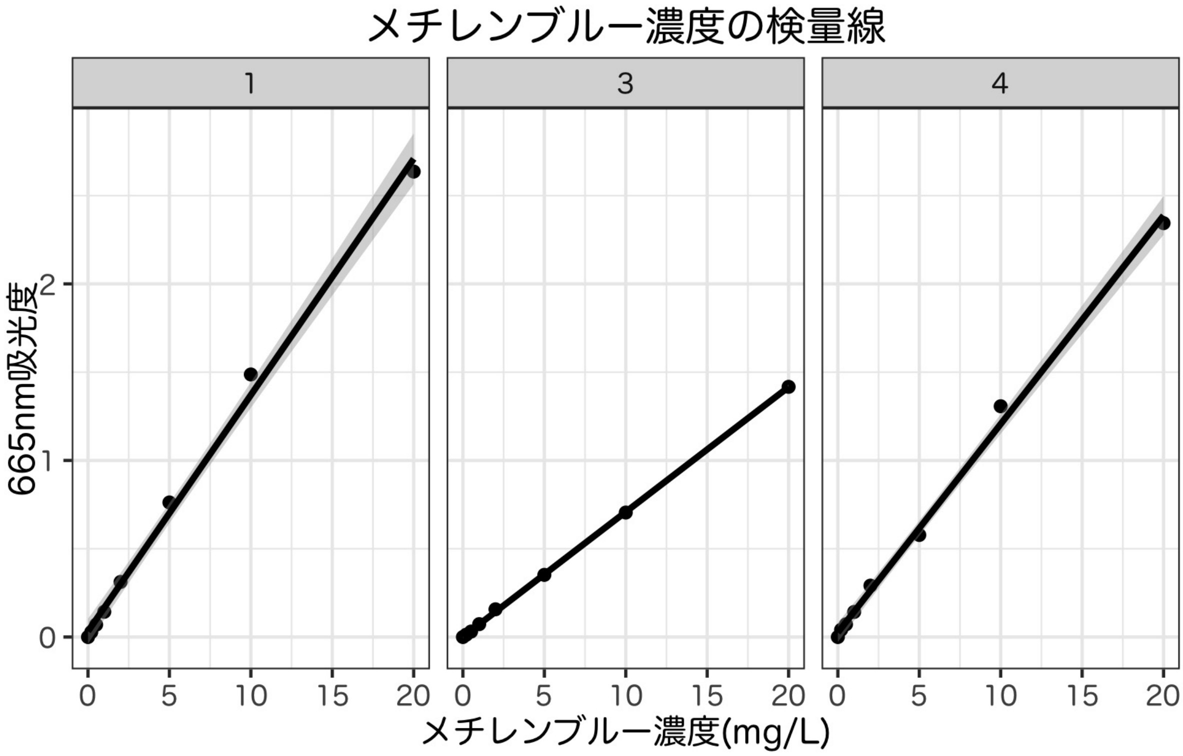
実験概要

オゾン処理は主に高度処理で用いられ、

結果

まず、メチレンブルー濃度算出に用いる検量線を作成した。各班の実測値は以下の通り。

上記のデータを用いて最小二乗法で検量線を作成したところ、今回採用した希釈段階の全域に渡ってデータは線形な変化であることを確認することができた。



上記の検量線を用いて、各時刻でのメチレンブルー濃度の変化を導出した。pH・オゾン濃度・TOC 濃度の実測値と合わせ、以下に結果を示す。

上記の検量線を用いてメチレンブルー濃度を計算し、時間変化を図示すると以下のようになった。

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
```

時間. 分.	吸光度	吸光度_希釈	pH	O3_conc	メチレンブルー濃度	TOC 濃度
3 - 酸性						
0	0.478	3	2.17	1.06	1	NA
2	NA	2	NA	NA	1	NA
4	0.001	1	NA	NA	1	NA
6	-0.001	1	NA	NA	1	NA
8	0.001	1	NA	NA	1	NA
10	-0.004	1	NA	NA	1	NA
15	-0.007	1	NA	NA	1	NA
20	-0.003	1	2.11	0.83	1	NA
3 - 中性						
0	5.799	3	7.00	1.06	1	NA
2	0.354	1	NA	NA	1	NA
4	0.153	1	NA	NA	1	NA
6	0.025	1	NA	NA	1	NA
8	-0.001	1	NA	NA	1	NA
10	0.002	1	NA	NA	1	NA
15	-0.005	1	NA	NA	1	NA
20	-0.002	1	7.01	0.03	1	NA
3 - アルカリ性						
0	5.217	3	12.25	1.06	1	NA
2	0.379	1	NA	NA	1	NA
4	0.256	1	NA	NA	1	NA
6	0.140	1	NA	NA	1	NA
8	0.068	1	NA	NA	1	NA
10	0.053	1	NA	NA	1	NA
15	0.017	1	NA	NA	1	NA
20	0.005	1	11.88	0.00	1	NA
1 - 酸性						
0	1.743	4	2.51	0.54	1	NA
2	1.287	1	NA	NA	1	NA
4	0.317	1	NA	NA	1	NA
6	0.065	1	NA	NA	1	NA
8	0.019	1	NA	NA	1	NA
10	0.007	1	NA	NA	1	NA
15	0.007	1	NA	NA	1	NA
20	0.007	1	2.53	0.10	1	NA
1 - 中性						
0	1.439	4	7.10	0.54	1	NA
2	1.627	1	NA	NA	1	NA
4	0.087	1	NA	NA	1	NA
6	0.017	1	NA	NA	1	NA
8	0.011	1	NA	NA	1	NA
10	0.005	1	NA	NA	1	NA
15	0.001	1	NA	NA	1	NA
20	0.000	1	6.97	0.02	1	NA
1 - アルカリ性						

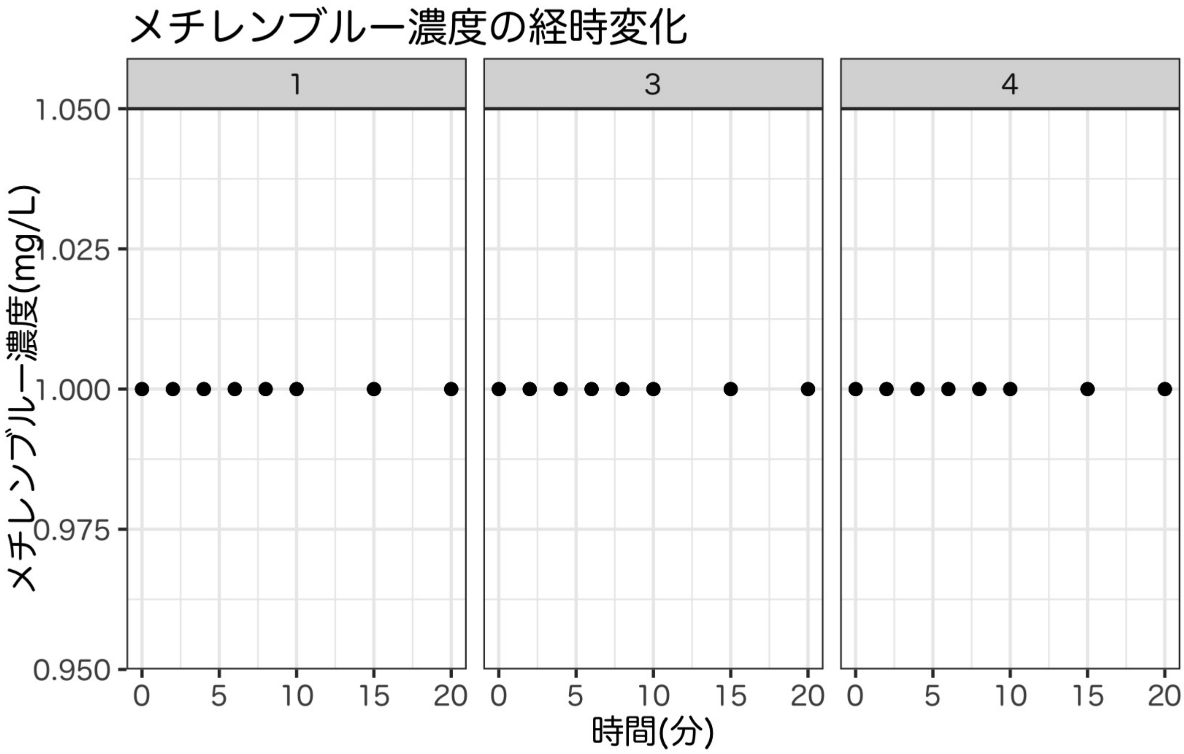
```
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
```

```
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
```

```
family 'Hiragino Maru Gothic Pro' not found in PostScript font database

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```



考察

課題 B 急速濾過における目詰まり状況と処理性能の解析

実験概要

結果

考察

課題 C 活性炭による色度成分の吸着

実験概要

BELLSORP mini による解析

結果

また、BELLSORP mini により活性炭の細孔分布について解析した結果を示す。

まず以下はそれぞれの活性炭の等温吸着曲線である。

```
# R の readLines() で読み込みがうまくいかなかったのでシェルで変換。
iconv -f CP932 -t utf-8 GLC1203.DAT > GLC1203.txt
iconv -f CP932 -t utf-8 GW1203.DAT > GW1203.txt
```

```
Warning: There was 1 warning in `mutate()`.
i In argument: `t_nm = de_Boer(Pe, P0)`.
Caused by warning in `log()`:
! NaNs produced
```

```
GLC_isthm_plt <- GLC_df %>%
  ggplot(mapping=aes(x=prsr, y=V))+
  geom_point()+
  labs(
    title = "GLC 活性炭の等温吸着曲線",
    x="相対圧",
    y="吸着量"
  )+
  theme_bw()+
  theme(text=element_text(family=hiragino))

GW_isthm_plt <- GW_df %>%
  ggplot(mapping=aes(x=prsr, y=V))+
  geom_point()+
  labs(
```

```
    title = "GW 活性炭の等温吸着曲線",
    x="相対圧",
    y="吸着量"
  )+
  theme_bw()+
  theme(text=element_text(family=hiragino))

grid.arrange(GLC_isthm_plt,GW_isthm_plt, nrow=1)
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

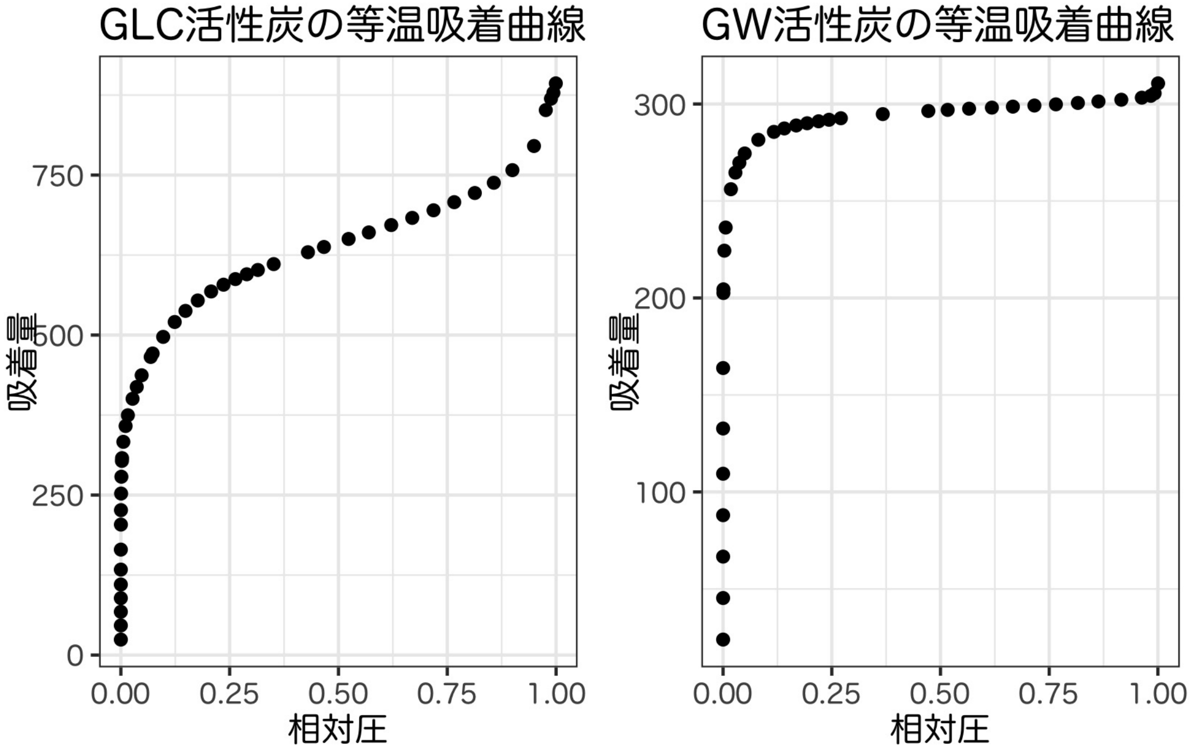
```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
```

```
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```



次に、t-plot を示す。

```
Warning: Removed 7 rows containing missing values or values outside the scale range
(`geom_point()`).
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning: Removed 1 row containing missing values or values outside the scale range
(`geom_point()`).
```

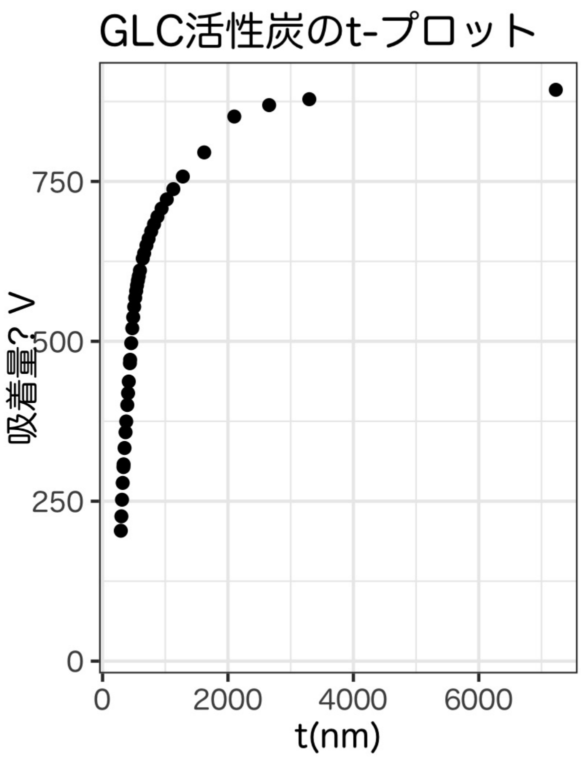
```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

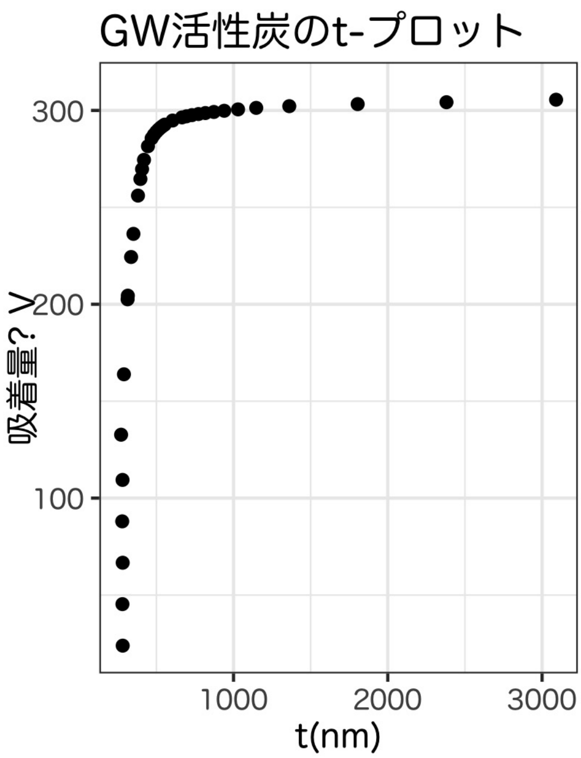
```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
```

```
family 'Hiragino Maru Gothic Pro' not found in PostScript font database

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```





また、以下のような BET プロットを描画することで、表面積を概算することができる。

```
GLC_BET_plt <- GLC_df %>%
  ggplot(mapping=aes(x=prsr,y=BET))+
  geom_point()+
  labs(
    title = "GLC 活性炭の BET-プロット",
    x="相対圧",
    y="??"
  )+
  theme_bw()+
  theme(text=element_text(family=hiragino))

GW_BET_plt <- GW_df %>%
  ggplot(mapping=aes(x=prsr,y=BET))+
  geom_point()+
  labs(
    title = "GW 活性炭の BET-プロット",
    x="相対圧",
    y="??"
  )+
```

```r
  theme_bw()+
  theme(text=element_text(family=hiragino))

grid.arrange(GLC_BET_plt, GW_BET_plt, nrow=1)
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

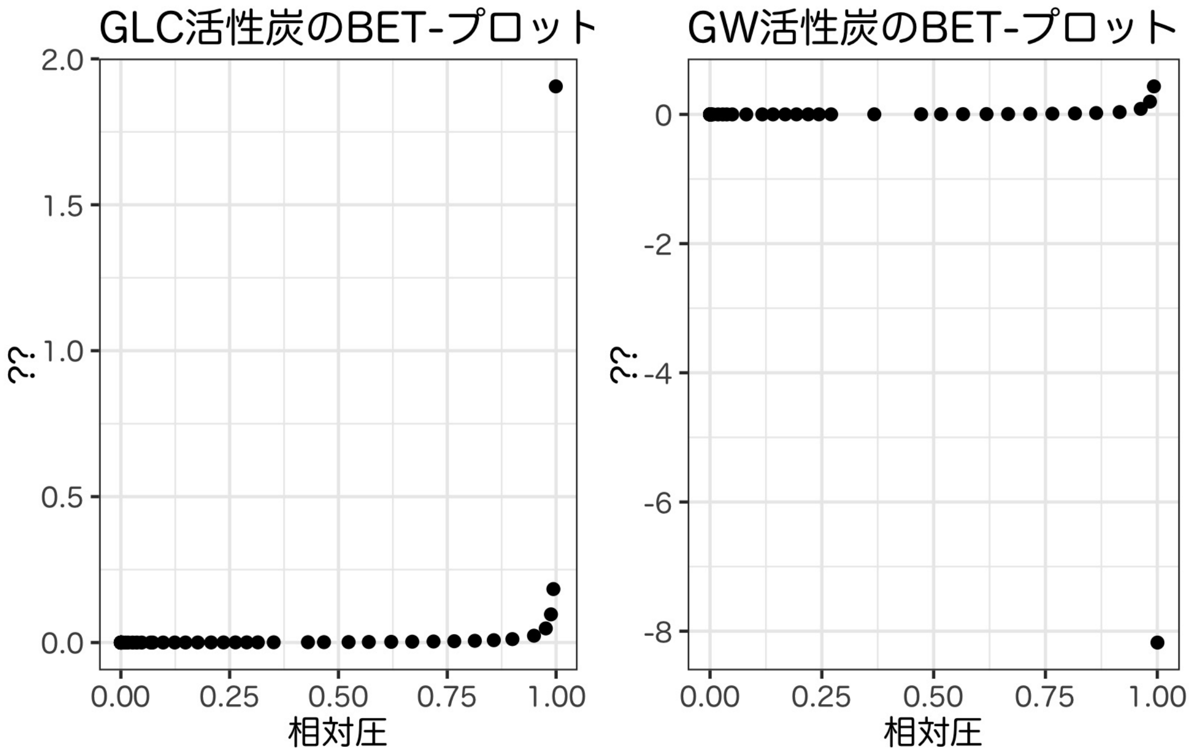
```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
```

```
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : font
family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```

```
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x$label), x$x, x$y, :
font family 'Hiragino Maru Gothic Pro' not found in PostScript font database
```



考察

課題 D 凝集沈殿における最適条件の決定

実験概要

概要をここに書く。

結果

まず、二種類の水試料について、凝集剤の濃度を変化させて凝集剤の最適添加量を求めた。実験結果は以下のようになった。

凝集剤添加量の決定

					滴定の生データ		
凝集剤濃度	濁度	pH. 後.	水温	m アルカリ度	滴定_前	滴定_後	滴定試料量
三四郎							
0	6.508	7.12	11.6	4.47	19.69	15.68	100
10	6.512	7.18	11.6	4.30	15.68	11.82	50
20	4.281	7.16	11.6	4.05	11.82	8.19	50
50	1.037	7.10	11.6	3.50	8.19	5.05	50
75	1.175	6.40	11.6	2.94	5.05	2.41	50
100	2.362	6.44	11.6	2.44	2.41	0.22	50
カオリン							
0	3.574	6.99	20.7	2.00	6.90	5.11	50
10	3.630	7.17	20.7	1.81	5.11	3.49	50
20	2.134	7.00	20.7	1.65	3.49	2.01	50
50	3.982	6.87	20.7	1.22	2.01	0.92	50
75	5.790	6.48	20.7	0.52	0.92	0.45	50
100	6.949	5.90	20.7	0.14	0.45	0.32	50

: This is a table

また、m-アルカリ度

最適な凝集剤添加条件は以下のように求められた。

次に、上記で求めた最適量の凝集剤を添加した上で、pH を酸性~アルカリ性の数段階で変化場合の各化学指標の経時変化を以下に示す。

各phでの反応の比較

							滴定の生データ		
理論pH	pH前	pH後	濁度	ゼータ電位	水温	mアルカリ度	滴定_前	滴定_後	滴定試料量
三四郎									
pH3	3.33	3.41	5.414	-9.081	NA	NA	NA	NA	50
pH5	5.57	4.96	1.649	-9.213	NA	NA	NA	NA	50
pH7	7.66	7.29	0.662	-9.921	NA	3.44	3.51	0.42	50
pH9	8.88	7.62	4.241	-10.440	NA	3.98	7.08	3.51	50
pH11	10.47	9.89	1.448	-13.930	NA	6.77	13.15	7.08	50
カオリン									
pH3	3.88	3.48	3.679	-12.770	19.3	NA	NA	NA	50
pH5	4.57	4.55	3.796	-18.820	19.3	NA	NA	NA	50
pH7	7.10	7.23	3.241	-10.390	19.3	1.63	14.61	13.15	50
pH9	8.55	7.73	2.088	-17.640	19.3	1.87	16.29	14.61	50
pH11	10.67	10.48	3.830	-15.340	19.3	5.72	21.42	16.29	50

考察

考察をここに書く

課題E 消毒

実験概要

2種類の消毒方法に関して実験を行う。

結果

```r
# to be removed after I changed the csvs to a single excel file
colony <- read.csv("colony.csv")
```

大腸菌コロニー数の計数結果

採水時刻	コロニー数
3 - 塩素 - 水道水	
t0	$\mathbf{>300/>300}(\times 10^3)$, $\mathbf{100/91}(\times 10^4)$, $\mathbf{7/3}(\times 10^5)$
t1	$\mathbf{8/5}(\times 10^2)$, $\mathbf{1/0}(\times 10^3)$, $\mathbf{0/0}(\times 10^4)$
t2	$\mathbf{158/148}(\times 10^1)$, $\mathbf{16/9}(\times 10^2)$, $\mathbf{2/0}(\times 10^3)$

t3	$\mathbf{178/173}(\times 10^1)$, $\mathbf{23/21}(\times 10^2)$, $\mathbf{3/1}(\times 10^3)$
3 - 塩素 - 緩衝液 A	
t0	$\mathbf{>300/>300}(\times 10^3)$, $\mathbf{87/83}(\times 10^4)$, $\mathbf{15/10}(\times 10^5)$
t1	$\mathbf{6/12}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$, $\mathbf{0/0}(\times 10^4)$
t2	$\mathbf{148/129}(\times 10^1)$, $\mathbf{25/17}(\times 10^2)$, $\mathbf{3/2}(\times 10^3)$
t3	$\mathbf{97/90}(\times 10^1)$, $\mathbf{12/8}(\times 10^2)$, $\mathbf{3/2}(\times 10^3)$
3 - 塩素 - 緩衝液 B	
t0	$\mathbf{>300/>300}(\times 10^3)$, $\mathbf{172/155}(\times 10^4)$, $\mathbf{25/18}(\times 10^5)$
t1	$\mathbf{>300/>300}(\times 10^2)$, $\mathbf{>300/>300}(\times 10^3)$, $\mathbf{62/44}(\times 10^4)$
t2	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{432/364}(\times 10^3)$
t3	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{109/79}(\times 10^3)$
3 - 紫外線 - BW	
t0	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{278/185}(\times 10^3)$, $\mathbf{25/18}(\times 10^4)$
t1	$\mathbf{271/258}(\times 10^1)$, $\mathbf{35/30}(\times 10^2)$, $\mathbf{5/3}(\times 10^3)$
t2	$\mathbf{0/0}(\times 10^1)$, $\mathbf{1/0}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$
t3	$\mathbf{0/0}(\times 10^1)$, $\mathbf{0/0}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$
3 - 紫外線 - phr	
t0	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{>300/>300}(\times 10^3)$, $\mathbf{57/46}(\times 10^4)$
t1	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{161/107}(\times 10^3)$
t2	$\mathbf{51/49}(\times 10^1)$, $\mathbf{7/3}(\times 10^2)$, $\mathbf{1/0}(\times 10^3)$
t3	$\mathbf{0/0}(\times 10^1)$, $\mathbf{0/0}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$
3 - 紫外線 - uvr	
t0	$\mathbf{>300/>300}(\times 10^1)$, $\mathbf{>300/>300}(\times 10^2)$, $\mathbf{259/244}(\times 10^3)$, $\mathbf{30/28}(\times 10^4)$
t1	$\mathbf{>300/253}(\times 10^1)$, $\mathbf{31/26}(\times 10^2)$, $\mathbf{4/3}(\times 10^3)$
t2	$\mathbf{40/6}(\times 10^1)$, $\mathbf{0/0}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$
t3	$\mathbf{0/0}(\times 10^1)$, $\mathbf{0/0}(\times 10^2)$, $\mathbf{0/0}(\times 10^3)$

考察